

DEVELOPMENT OF AN ALL POSITION
AUTOMATIC WELDING MACHINE

December, 1976

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FOREWORD

The purpose of this report is to present the results of one of the research and development programs which was initiated by the members of the Ship Production Committee of The Society of Naval Architects and Marine Engineers and financed largely by government funds through the cost sharing contract between the U.S. Maritime Administration and Bethlehem Steel Corporation. The effort of this project was directed to the development of improved methods and hardware applicable to shipyard welding in the U.S. shipyards.

Mr. W. C. Brayton, Bethlehem Steel Corporation, was the Program Manager. Mr. Malcolm T. Gilliland designed and directed the development work at the Gilliland plant at Peach Tree City, Georgia.

Special acknowledgement is made to the members of Welding Panel SP-7 of the SNAME Ship Production Committee who served as technical advisors in the preparation of inquiries and evaluation of sub-contract proposals.

EXECUTIVE SUMMARY

BACKGROUND

Several vertical butt welding processes are presently available for shipyard use. The equipment currently marketed however has some shortcomings. The production and maintenance experience of most yards using this equipment has been disappointing, and the vendors in many cases have not been effectively responsive to the problems.

OBJECTIVE

Develop a welding machine capable of making continuous fully automatic welds on transverse butt joints economically any place on the shell of a ship.

ACHIEVEMENT

The objective was accomplished with respect to hardware in that a machine capable of propelling and controlling the welding heads was built and tested. In order to fully utilize all of the potential hardware, however, it would be necessary to develop processes and procedures which would produce acceptable welds in such high stress areas as the bilge.

ACHIEVEMENT (continued)

Rather than delay development of the total project it was decided to direct present effort to the development of a practical vertical electroslog welder capable of welding vertical shell butts aboard ship and defer new process development and combine it with the effort of one side welding.

A prototype vertical butt welding machine was put into production at Avondale in December 1974 and a few months later a second prototype was put into production at Sparrows Point. Presently at least twelve of these units are in production in several U.S. shipyards and several more are on order and under consideration by other yards.

DEVELOPMENT OF AN ALL POSITION AUTOMATIC WELDING MACHINE

BACKGROUND

Several vertical welding processes have been used with limited success for welding vertical shell butts. Both electrogas and electroslog processes have been used. The inherent disadvantage of the electrogas system for shipyard use is wind problem with shielding gas. The electroslog process effectively eliminates this problem and recent developments in cored electrodes have improved the deposition efficiency.

Existing equipment was not capable of consistently acceptable performance. Problems with wire feeding and carriage travel and tracking made the equipment difficult to operate and costly to maintain. Equipment vendors generally have not been effectively responsive to the problems of the shipyards.

APPROACH

The thoughts and comments from the people who had actual production experience were collected from the Welding Panel SP-7 of the ship production committee of S .N .A .M .E. and used to formulate a performance specification for a machine capable of making continuous fully automatic welds on transverse butt joints economically any place on the shell of the ship.

SPECIFICATION :

1. The process and apparatus employed shall be capable of welding transverse butts in the shell of a ship in a single pass with automatic tracking.
2. The system should be capable of starting to weld at the point of tangency with the bottom to the upper edge of the shear strake.
3. If it is determined that process limitations prevent complete effective accomplishment of the foregoing requirement, the practical effective limits of travel shall be specified in the proposal.
4. It is assumed that a machine which would have restrictive limitations would be less complex, less costly and significantly more efficient within its operating limits. Alternate proposals could be considered for evaluation.
5. The minimum radius of curvature around the bilge might be 6 feet.
6. The range of plate thickness could be from $\frac{1}{2}$ " to $1\frac{1}{2}$ " and during the course of a continuous weld the thickness from plate to plate might vary by increments of $\pm\frac{3}{8}$ ".

SPECIFICATION: (cont'd.)

7. The gap or opening tolerance for fit-up shall be up to 1/8" more than the minimum requirement for connection between inner and outer shoes.
8. The system shall be capable of producing welds which exhibit acceptable quality and internal appearance and meet all physical requirements for A. B. S. grades of carbon steel plates for shipbuilding.

Vendors who in the past had not been very responsive to the problems posed by individual shipyards were not any more responsive to this specification. The proposal of Malcolm T. Gililand, Inc. was considered by Panel SP-7 to be the most innovative and completely responsive to the specification.

The total concept of the proposal included a machine capable of starting on the bottom shell and progressing through the bilge and up the side shell. This involved a transition from multiple submerged arc to electroslag welding by means of retractable sliding copper shoes and electrode wide tubes.

PERFORMANCE

The original prototype unit was developed around a carriage employing four wheel drive and controlled by a magnetic amplifier which maintains constant travel speed regardless of fluctuating torque and load requirements.

PERFORMANCE (cont'd.)

A mock-up made of two 1-1/2" thick plates rolled to a 6 ft. bilge radius with longitudinal framing cut outs 10" x 4" to simulate ship conditions was made for testing. Figures 1, 2, and 3 show the carriage in different positions along the mock-up jig.

The equipment was designed so that it would be as light as possible and so that it could be attached to the plate as easily and quickly as possible. The equipment attached to the plate consists of a four wheel positive drive system which is fastened to the plate with one spring loaded bolt mechanism. There are two inside and two outside groove guides.

The four wheel drive unit consists of one primary drive motor and gear box which drives two chain operated gear boxes from one main drive shaft. The gear boxes are machined from 6061-T6 aluminum so that the unit can be kept as light as possible. The four drive wheels are case hardened knurled wheels for positive grip to the plate surface. A spring loaded outside shoe arm is attached to the main drive shaft between the gear boxes. This outside water cooled shoe assembly is pinned to and pivots from the other end of the arm mechanism so that it may ride firmly against the plate.

PERFORMANCE (cont' d.)

The spring loaded bolt mechanism which fastens the unit to the plate is mounted to a yoke assembly which pivots from two pins off the top half of the unit. The yoke is designed to travel in the joint design which has a 50° included angle. The unit is mounted to the plate with this bolt, and the nut is simply tightened to the point that the spring applies enough pressure to keep the drive wheel from slipping as the unit moves. Attached to the forward most part of both the upper half and lower half of the equipment are the inside and outside groove guides. The groove guides simply serve the purpose of providing the tracking system so that the equipment travels in position as the weld is made.

In the first proto -type model, the upper half of the equipment contained two air cylinders which operated a water cooled shoe assembly. This copper backing shoe was positioned as the equipment made its way around the bilge radius and up into the vertical position.

The equipment was designed for six welding wires fed into the weldment in the flat position. The six wires were fed through three wire guide assemblies, each of which fed two wires. At the point in the course of making a weld where the unit began to start around the bilge radius, it is necessary to extinguish the arcs at two of the three wire feed guides. By doing this, only one wire guide would be used to complete the weld the rest of the way around the bilge and up the vertical

PERFORMANCE (cont'd.)

side shell to the shear strake. The wire guide assemblies are fastened to insulated guide plates and extended up through the weld joint.

Hardware which would perform the task set forth in the specification was developed and proven operable in the test jig; however, to date there are no acceptable welding processes for welding the flat transverse shell butts, or the bilge shell butts in high strength steel.

In accordance with items 3 and 4 of the specification it was decided that because of process limitations on part of the operation the program would be divided into three separate projects, namely:

1. A practical and efficient automatic electroslag machine that would weld vertical shell and bulkhead butts aboard ship.
2. In conjunction with project SP-7-703 "Field Applications of One side Welding", process development would continue simultaneously with the development of a practical and efficient automatic multiple submerged arc machine for welding bottom shell butts aboard ship.

PERFORMANCE. (cont'd)

3. After successful completion of the first two projects effort. would be applied to the development of a process which would be acceptable for the welding of bilge shell butts .

This concept differed from the original in that there might be three different specialized machines for the three different jobs rather than a single versatile machine to do all three. With this thought it was decided to direct the entire effort to completing the first project - a vertical machine.

Work continued at an accelerated pace until the first prototype vertical machine was demonstrated at Avondale in December 1974 and the second one .a few months later at Sparrows Point. Figure 4 shows the second prototype machine. in actual production on a 265,000 DWT tanker at the Sparrows Point yard of Bethlehem Steel Corporation.

After witnessing the demonstrations in actual production. orders for over 12 machines were placed by several other U.S. shipyards and they are presently in production and additional orders have been received.

Work has resumed on the process development on project No. 2 and that will be the subject of another report upon. the completion of the project.

CONCLUSION

The first phase of the project - Development of a vertical automatic electroslag butt welding machine has been successfully completed and the equipment is being marketed in the U.S. shipbuilding industry at a competitive price.

Full effort is presently being directed to process development of the second project and the integration of process with hardware to develop a bottom shell butt automatic welding machine .

For those who are interested in further details the following pages are devoted to detailed descriptions and illustrations of the equipment.

ACKNOWLEDGEMENT

The untiring effort of Mr. W. C. Alexander and Mr. D. Phillips and their staff at Avondale along with the similar effort of Mr. J. M. Craun and Mr. O. Tibbetts at Bethlehem helped immeasurably in the final development stage.

FIGURES

(Pages 13-16)

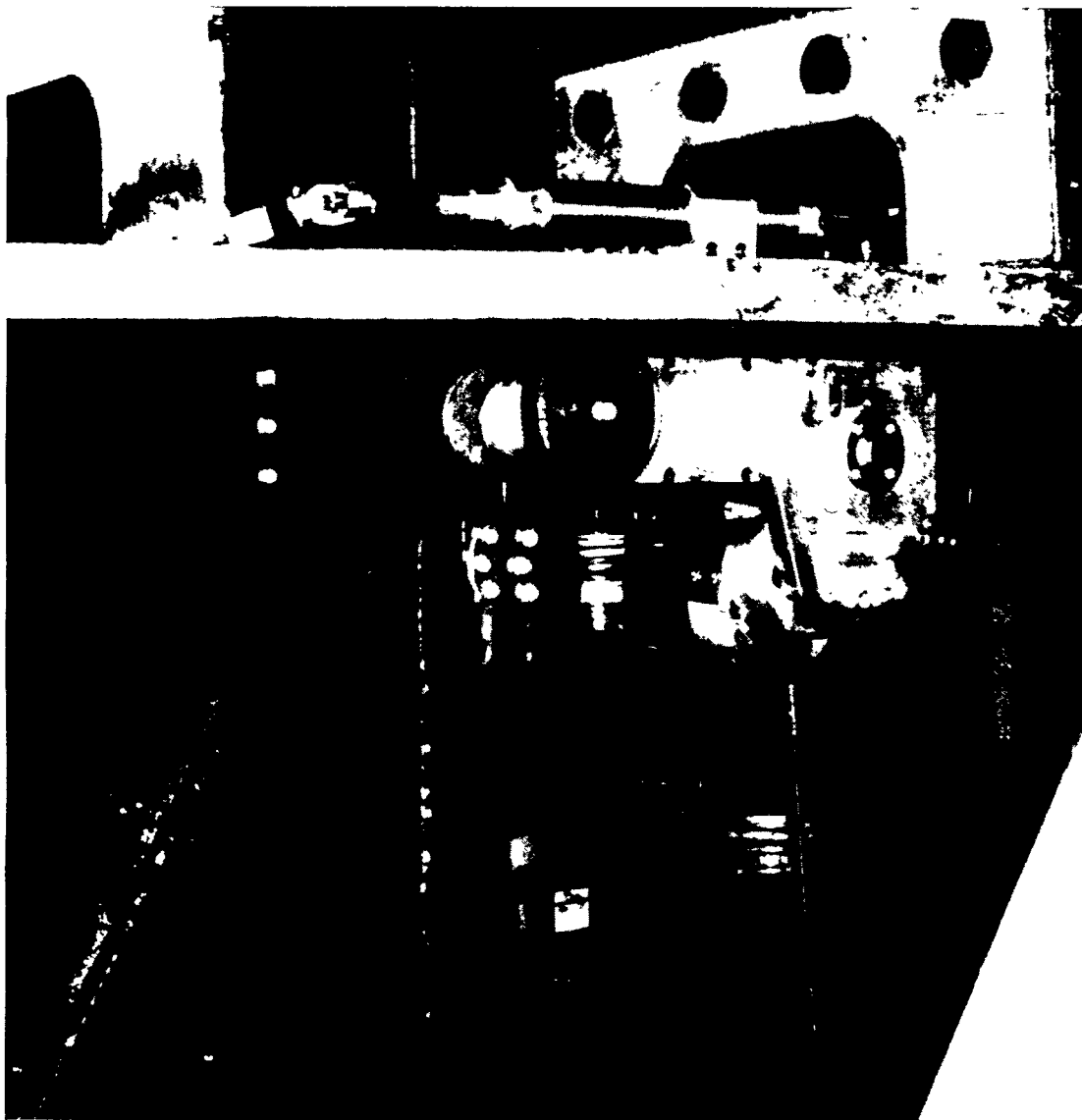


Fig. 1. Power Train on Horizontal Plane of Bilge Radius Mock-Up.

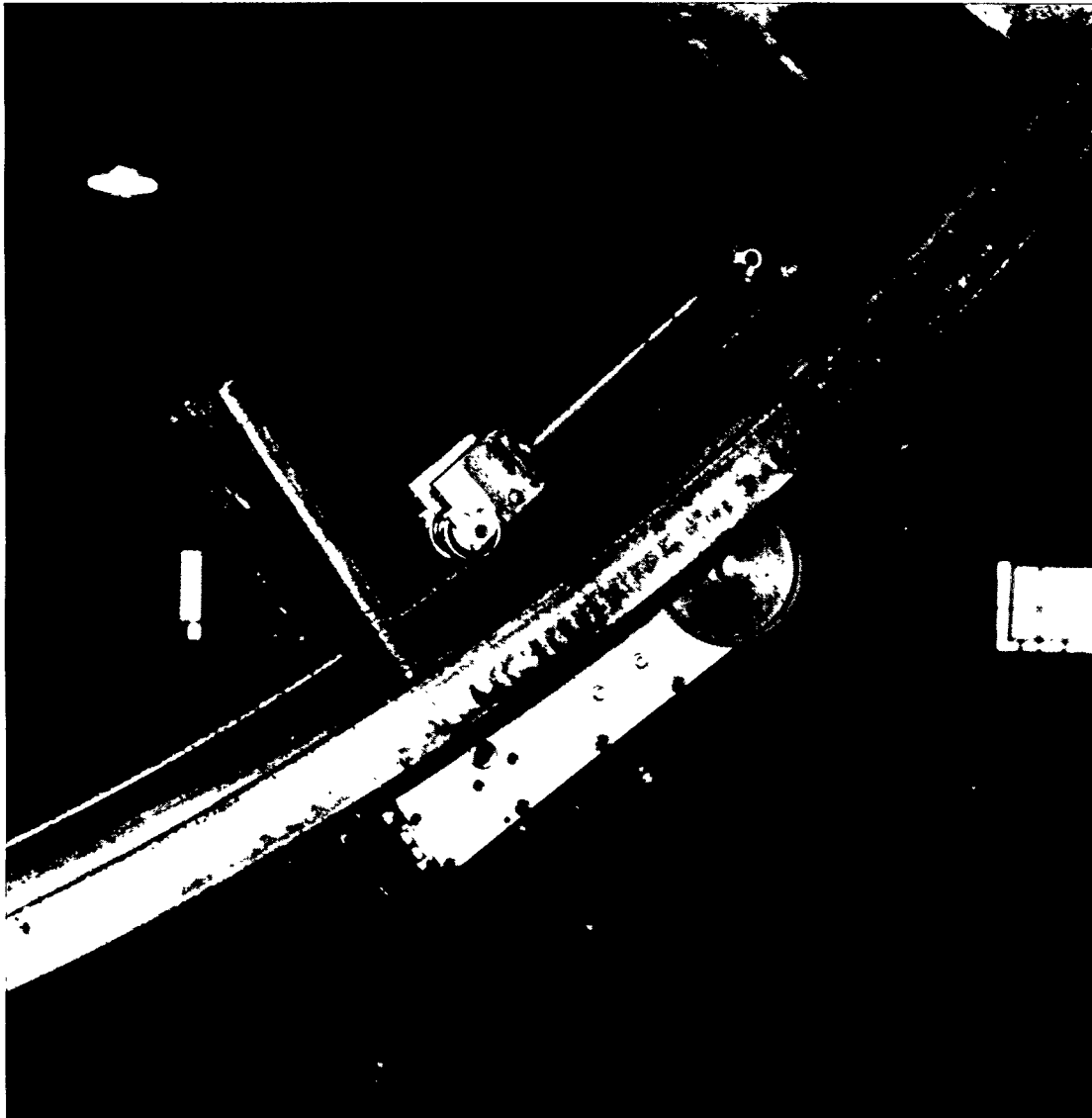


Fig. 2. Power Train Moving Around Bilge Radius Mock-Up.



Fig. 3. Power Train Moving into Vertical
Section of Bilge Radius Mock-Up.

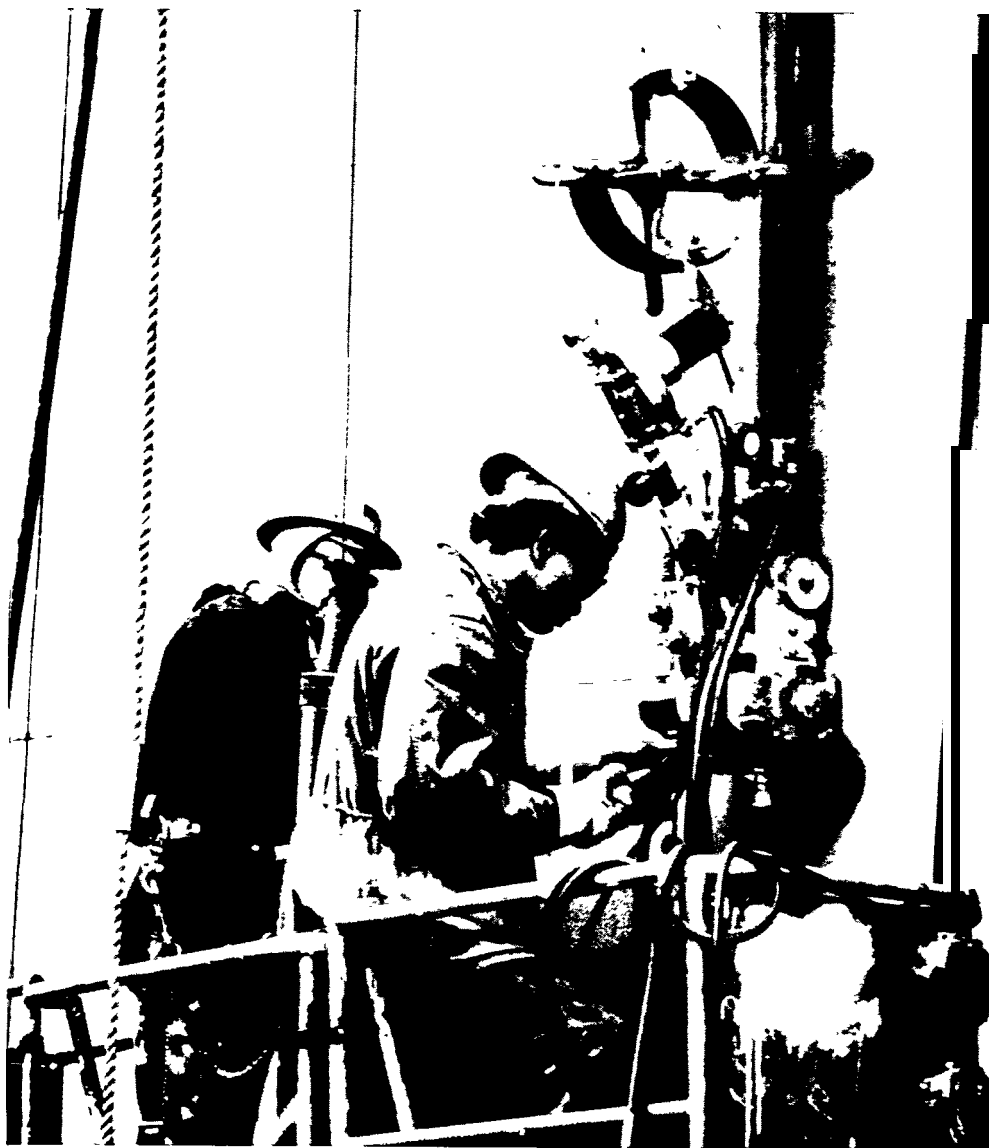
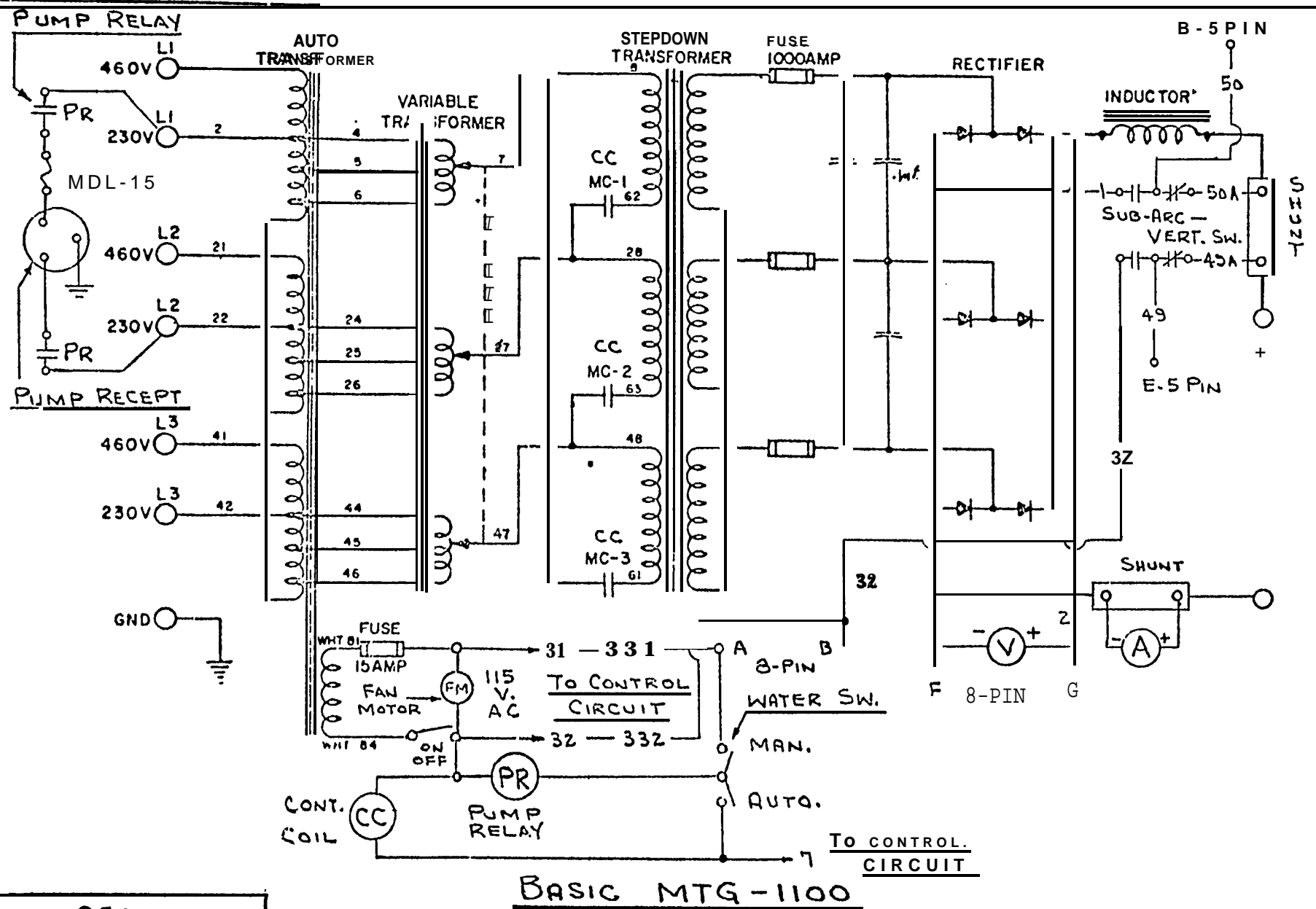


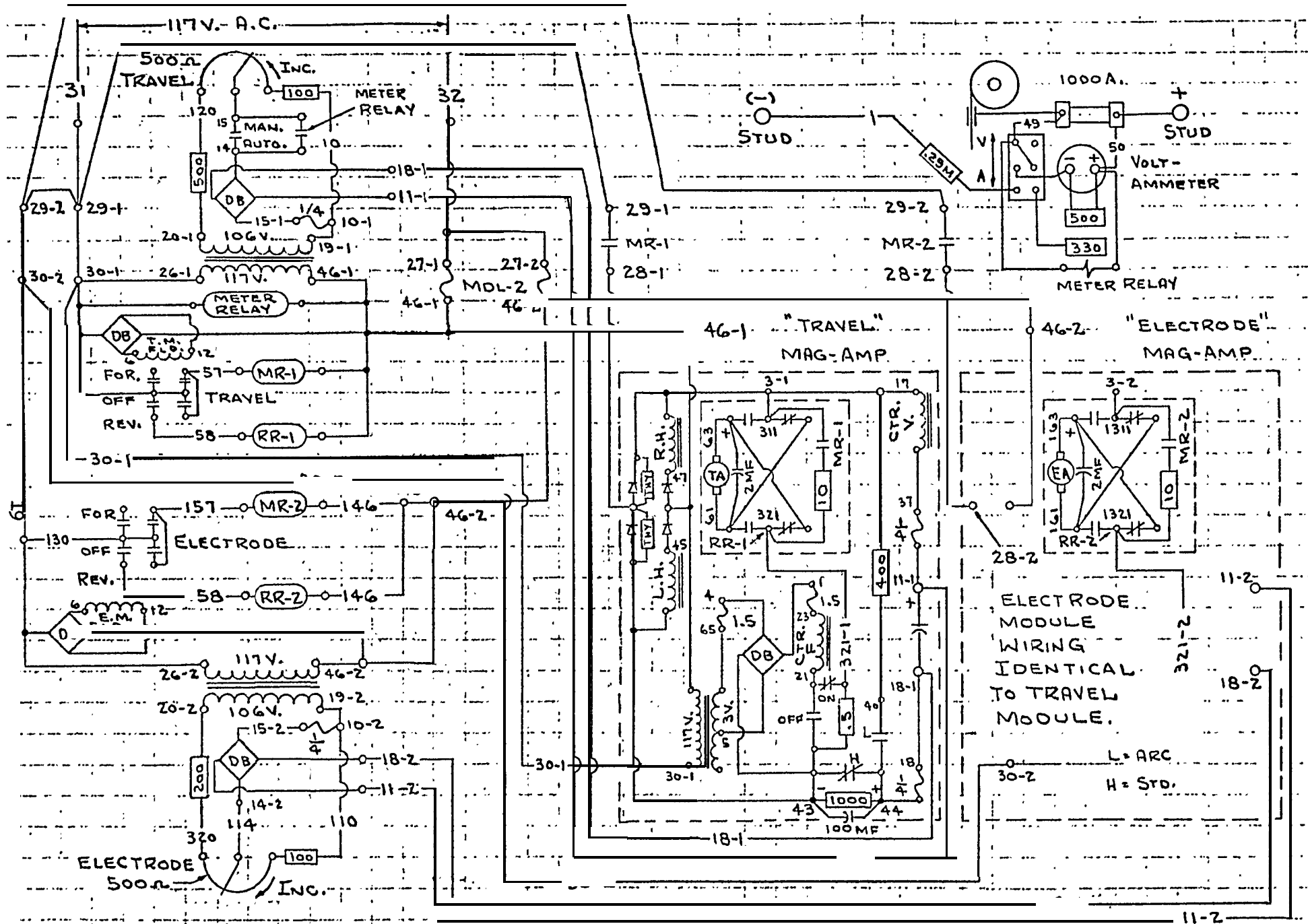
Fig. 4. Vertical Butt Welder in Operation on Side Shell.

ELECTRICAL SCHEMATICS

(Pages 18-25)



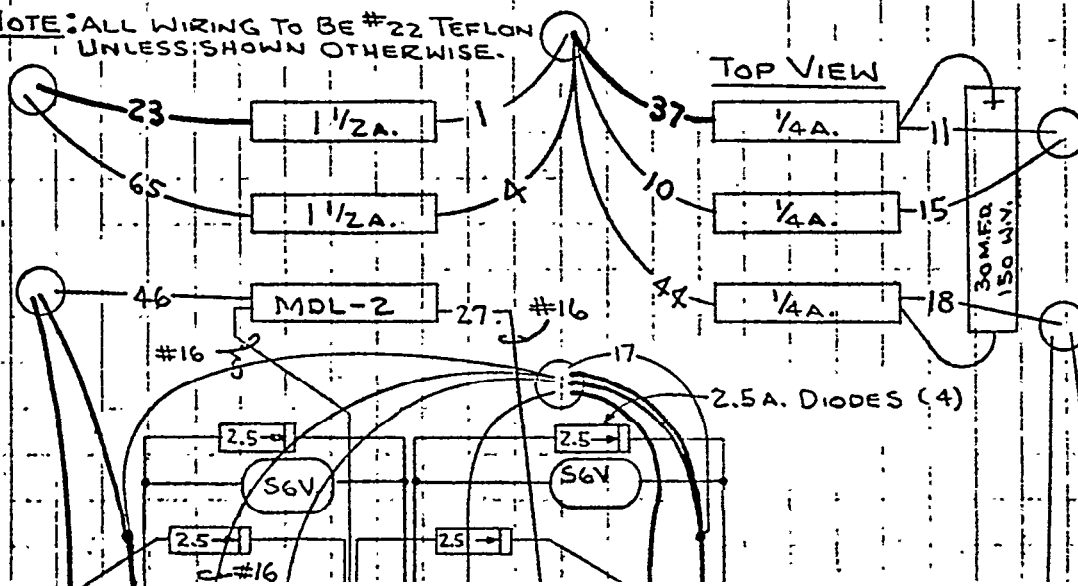
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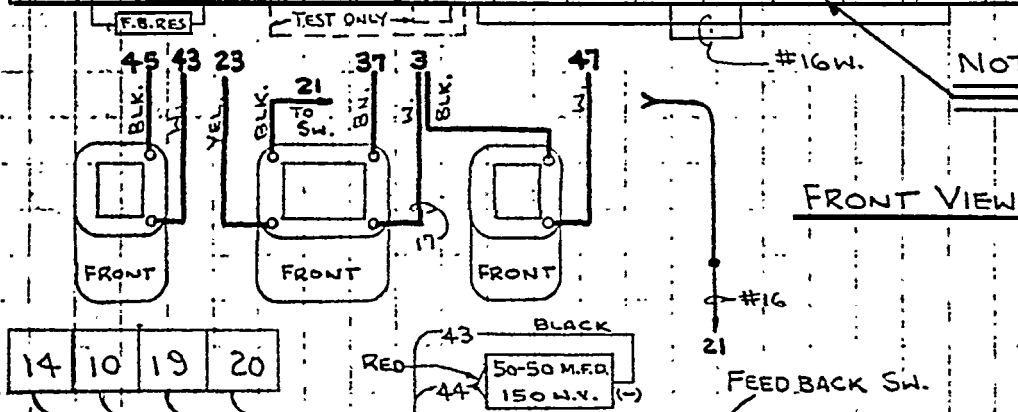
VERTICAL ELECTRO-SLAG SCHEMATIC WIRING DIAGRAM

MOTOR CONTROLS AND REMOTE METERING

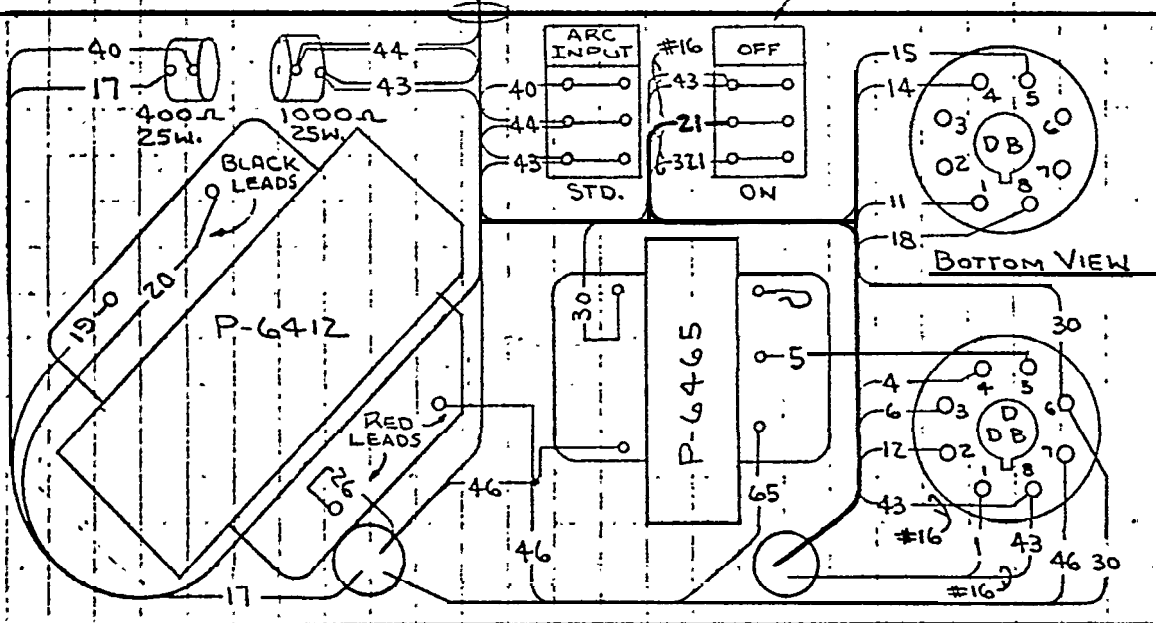
NOTE: ALL WIRING TO BE #22 TEFLON UNLESS SHOWN OTHERWISE.



45 43 321 26 46 28 30 27 47 3 311 50 51 29 6 12

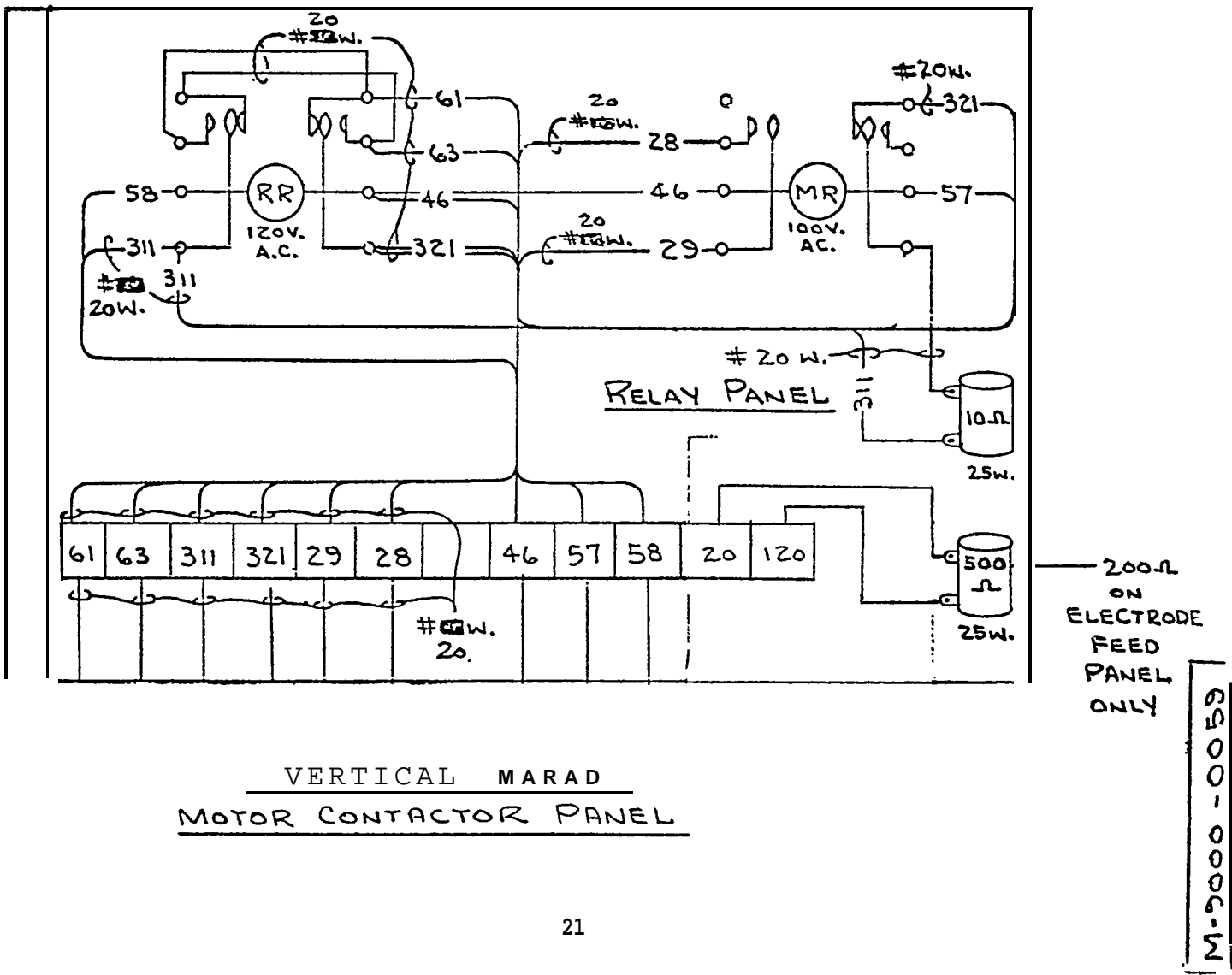


NOTE: USE CLOSED RING LUGS ON ALL T.B. LUGS EXCEPT DIODE PAIRS.

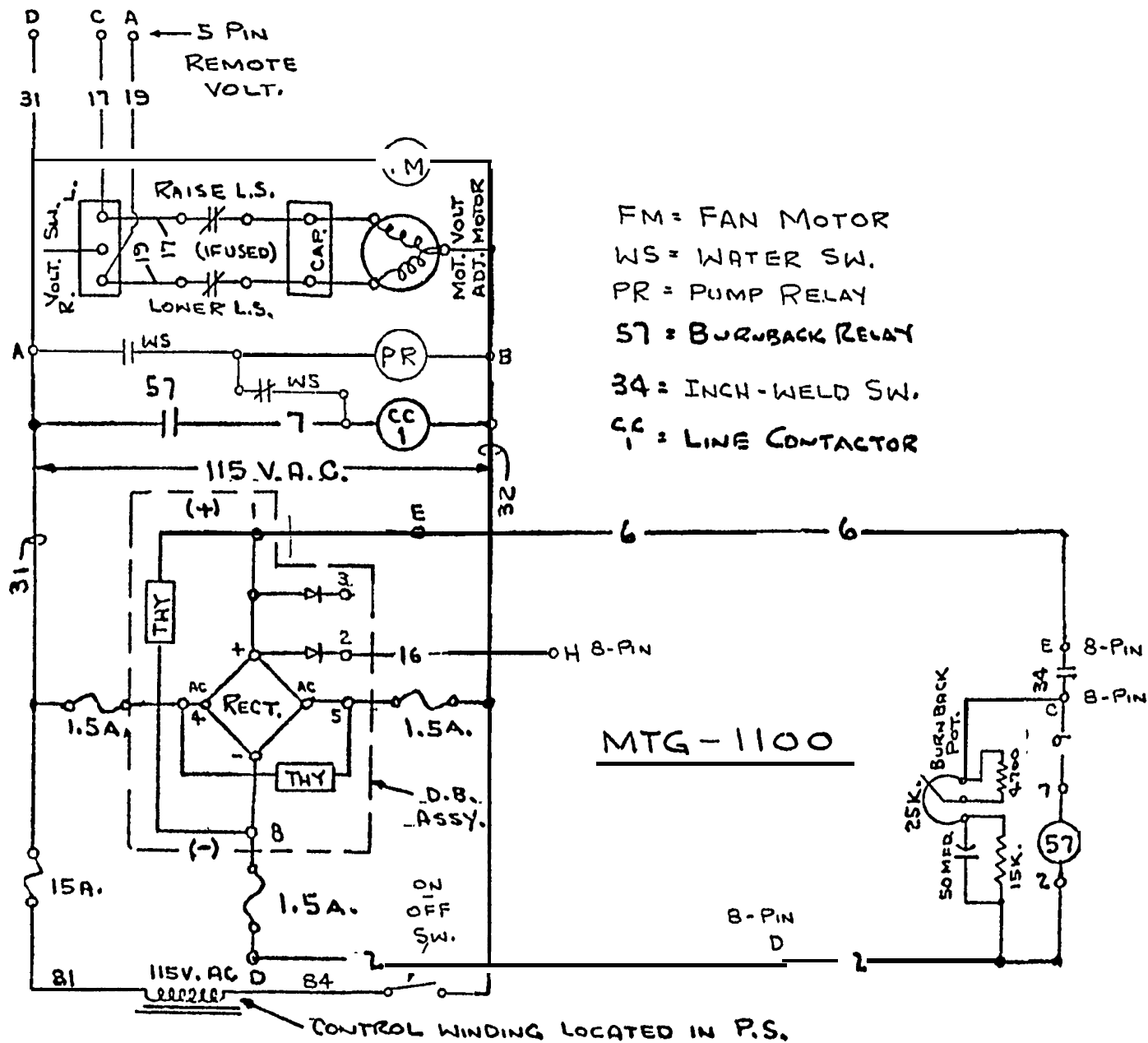


MAG-AMP PANEL FOR SHUNT MOTOR
MODULE
20

M-9000-0058



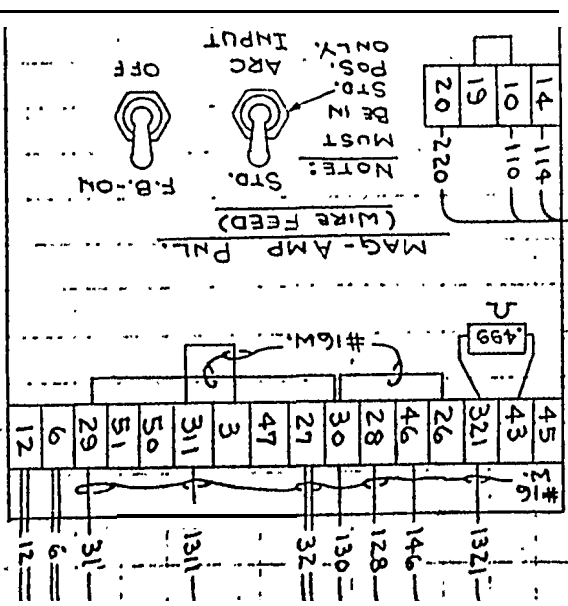
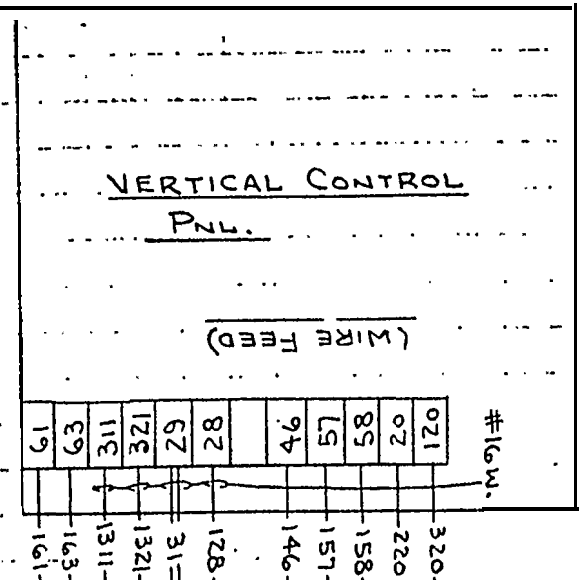
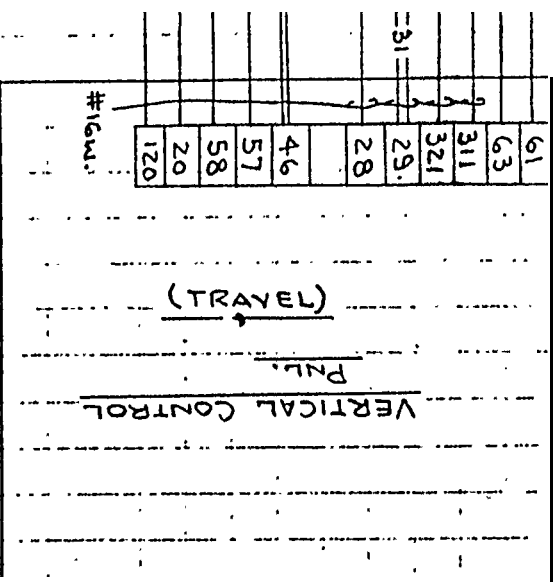
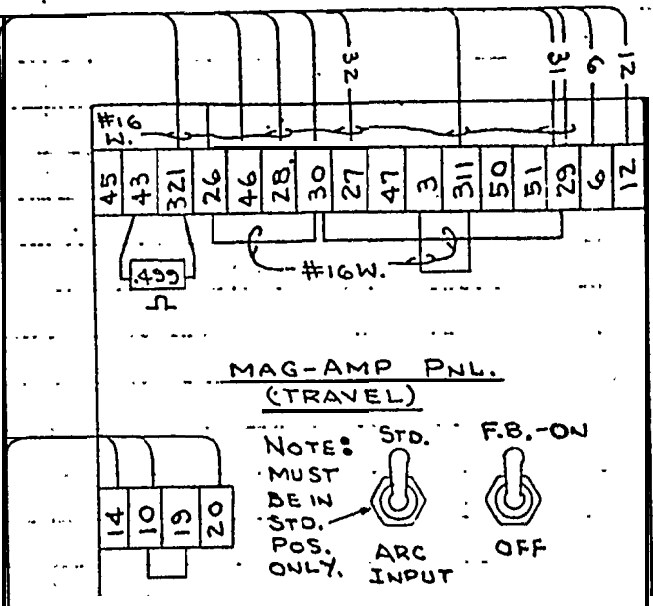
VERTICAL MARAD
MOTOR CONTACTOR PANEL



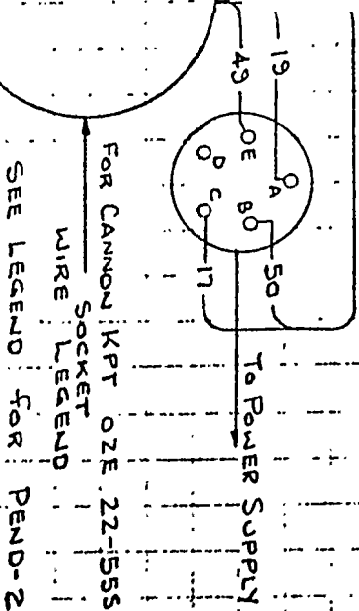
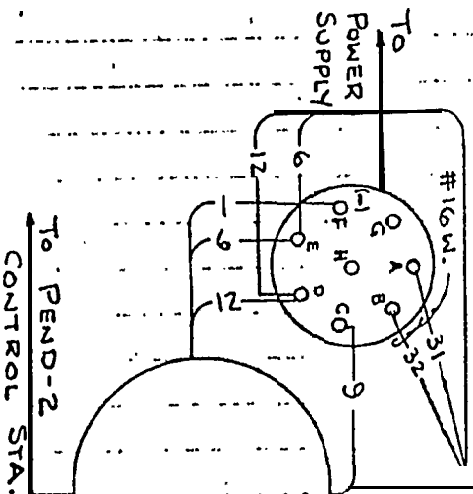
CONTACTOR CONTROL SCHEMATIC

MOTORIZED VOLTAGE CONTROL

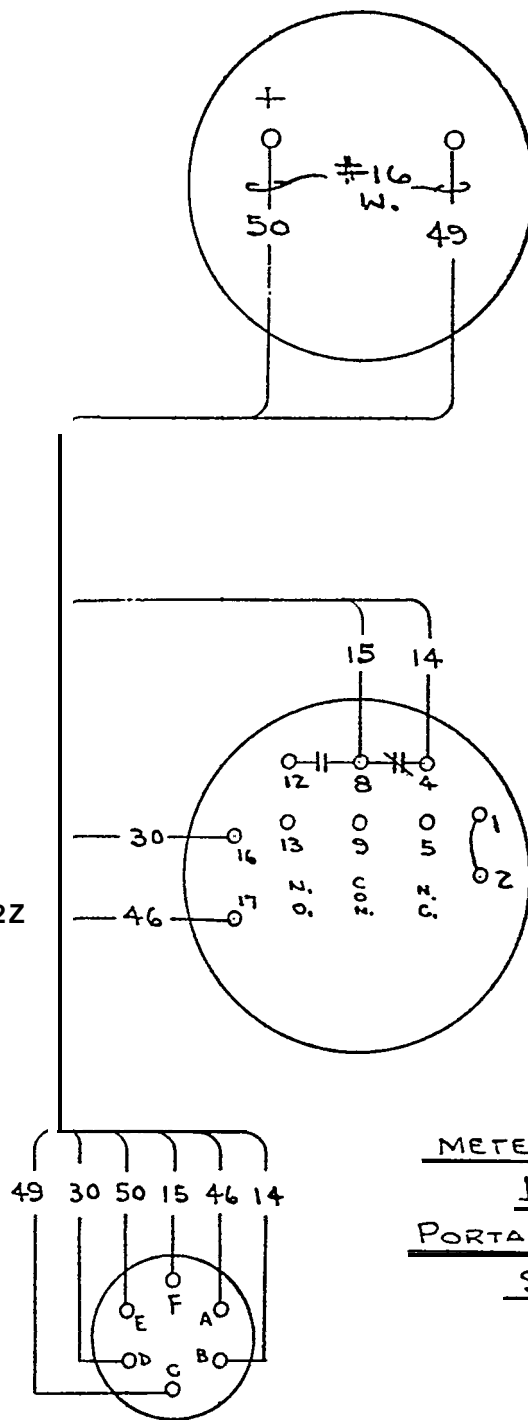
NOTE: ALL WIRING - #22 GA.
TEFLON EXCEPT AS NOTED.



MARAD
VERTICAL
WELDER



ALL WIRES#22
EXCEPT AS
NOTED.



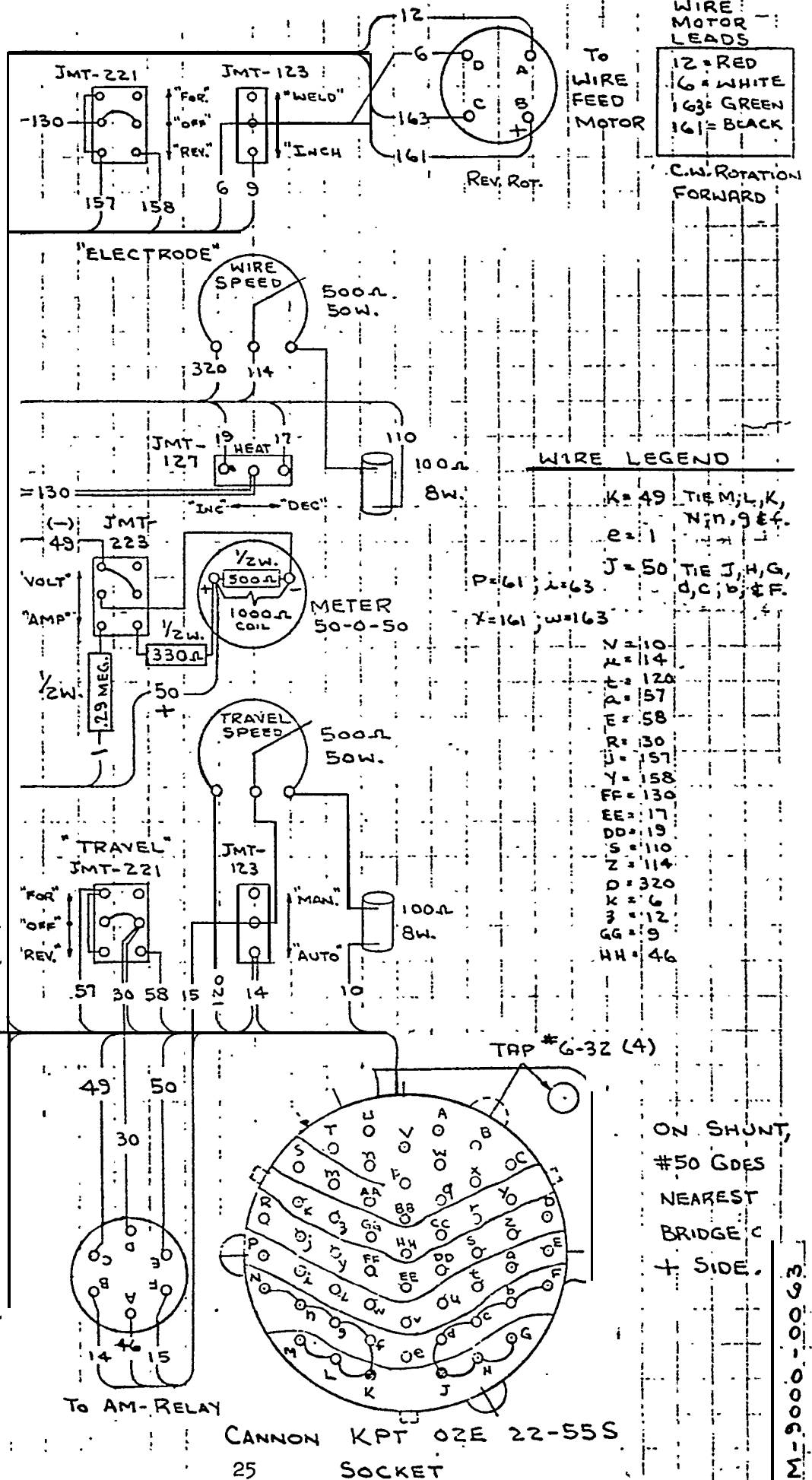
METER RELAY
1 K-AMP
PORTABLE AMMETER
STATION

M-9000-0062

NOTE:
ALL WIRING =
#22 TEFLON.

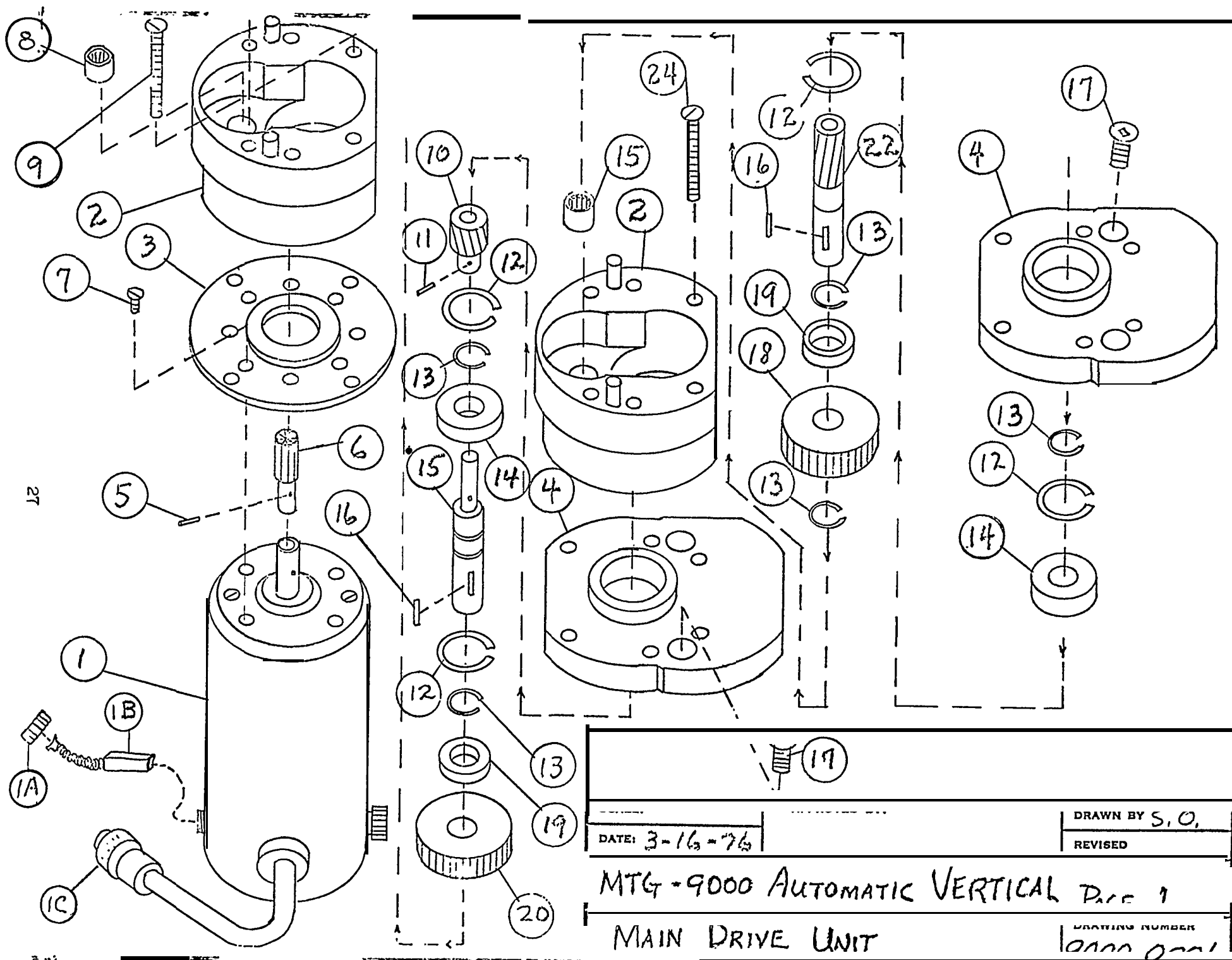
MARAD VERTICAL WELDER

CONTROL STATION



WELDER SCHEMATICS
AND PARTS LISTS

(Pages 27-85)



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MTG-9000 AUTOMATIC VERTICAL Page 1

MAIN DRIVE UNIT DRAWING NUMBER 100000001

27

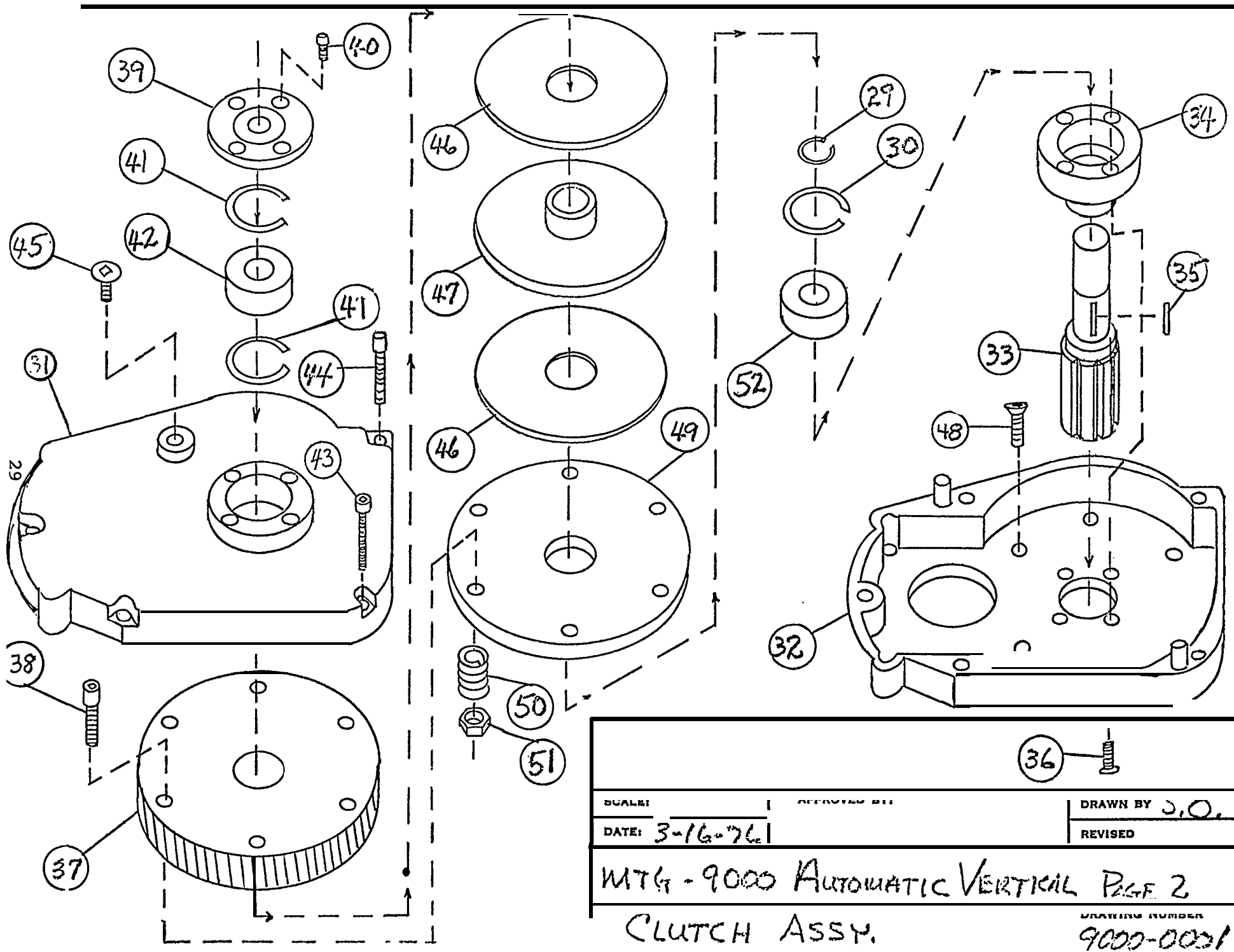
MTG-9000-0001 MAIN DRIVE UNIT, CLUTCH
ASSEMBLY & GEARED DRIVE UNITS PARTS LIST

SEE DRAWING NO. 9000-0001

Page 1

All Information Above This Line Must Accompany Parts Orders

Part No.	Description	Qty. Reqd.
9000-0001-1	Main drive motor	1
9000-0001-1A	Brush cap	2
9000-0001-1B	Brush	2
9000-0001-1C	4 pin male plug	1
9000-0001-2	Auxiliary gear housing	2
9000-0001-3	Motor adapter plate	1
9000-0001-4	Auxiliary gear housing cover	1
9000-0001-5	1/16 x 3/8 shaft pin	1
9000-0001-6	6 tooth pinion	1
9000-0001-7	Screw (6-32 x 3/8 FCSK)	4
9000-0001-8	Needle bearing	1
9000-0001-9	Screw (8-32 x 1-3/4 FCSK)	4
9000-0001-10	10 tooth pinion	1
9000-0001-11	1/16 x 3/8 shaft pin	1
9000-0001-12	Outboard retainer ring	4
9000-0001-13	Inboard retainer ring	5
9000-0001-14	Roller bearing	2
9000-0001-15	Auxiliary drive shaft	1
9000-0001-16	1/8 x 1/2 woodruff key	2
9000-0001-17	Cap screw (1/4-20 x 3/4 FCSKSH)	4
9000-0001-18	40 tooth gear	1
9000-0001-19	Gear spacer	2
9000-0001-20	56 tooth gear	1
9000-0001-22	Auxiliary driven pinion shaft	1



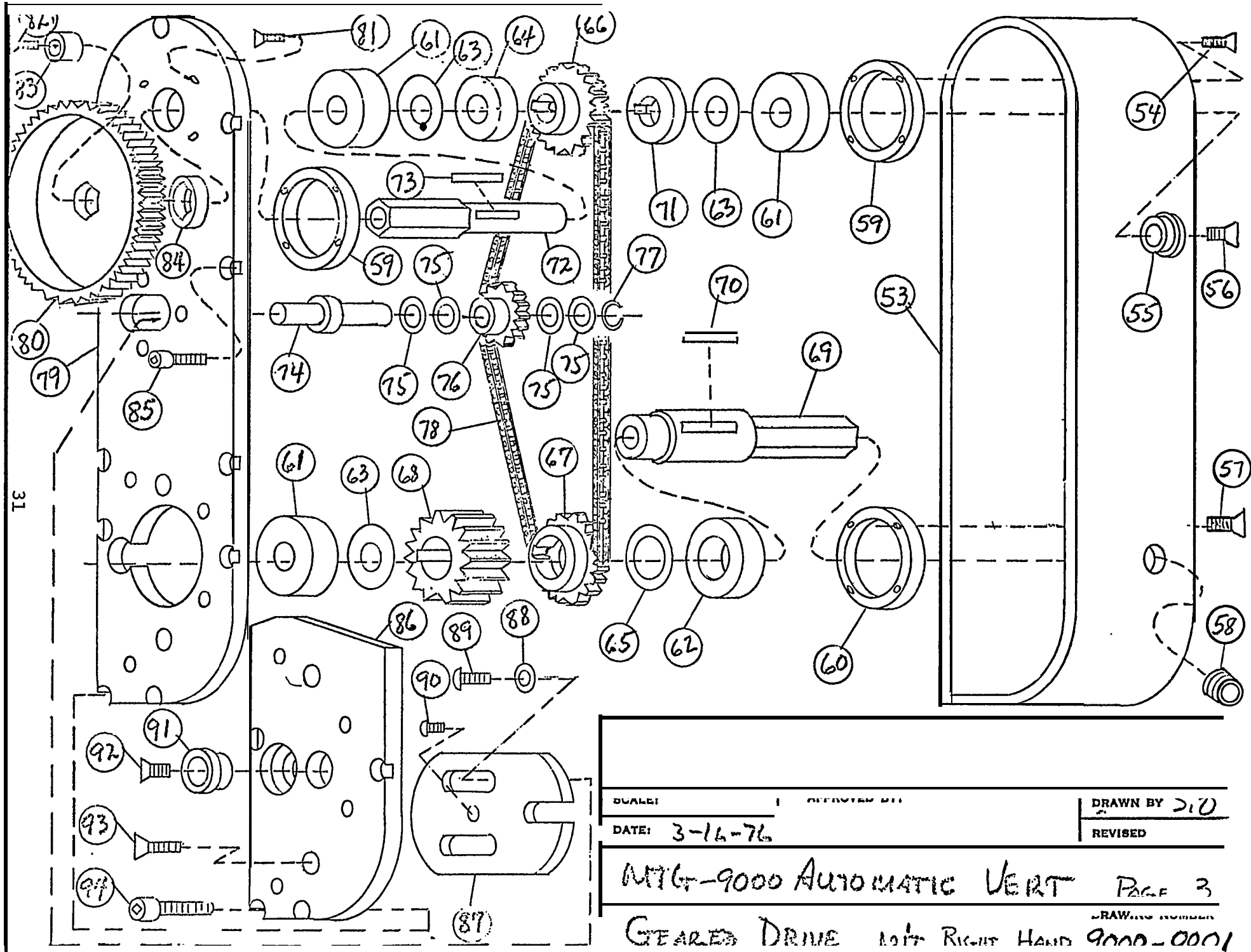
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MTG-9000-0001 MAIN DRIVE UNIT, CLUTCH
ASSEMBLY & GEARED DRIVE UNITS PARTS LIST

SEE DRAWING NO. 9000-0001
Page 2

All Information Above This Line Must Accompany Parts Orders

Part No.	Description	Qty. Reqd.
9000-0001-29	Retainer ring	1
9000-0001-30	Retainer ring	1
9000-0001-31	Top clutch housing	1
9000-0001-32	Bottom clutch housing	1
9000-0001-33	Main drive pinion	1
9000-0001-34	Bearing housing and adapter	1
9000-0001-35	3/32 x 1/2 shaft key	1
9000-0001-36	Screw (6-32 x 5/8 FCSK)	4
9000_0001_37	Clutch driving gear	1
9000-0001-38	Cap screw (10-32 x 1 SH).	6
9000-0001-39	Bearing cover cap	1
9000-0001-40	Cap screw (8-32 x 1/4 SH)	4
9000-0001-41	Retainer ring	2
9000-0001-42	Bearing	1
9000-0001-43	Cap screw (10-24 x 1 1/4 SH)	1
9000-0001-44	Cap screw (1/4-20 x 1 SH)	4
9000-0001-45	Cap screw (1/4-20 x 1/4 FSCKSH)	1
9000-0001-46	Clutch disc	2
9000-0001-47	Clutch driven hub	1
9000-0001-48	Cap screw (1/4-20 x 1 FSCKSH)	4
9000-0001-49	Clutch pressure plate	1
9000-0001-50	Clutch spring	6
9000-0001-51	Hex nut (10-32)	6
9000-0001-52	Roller bearing	1



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MTG-9000 AUTOMATIC VERT PAGE 3

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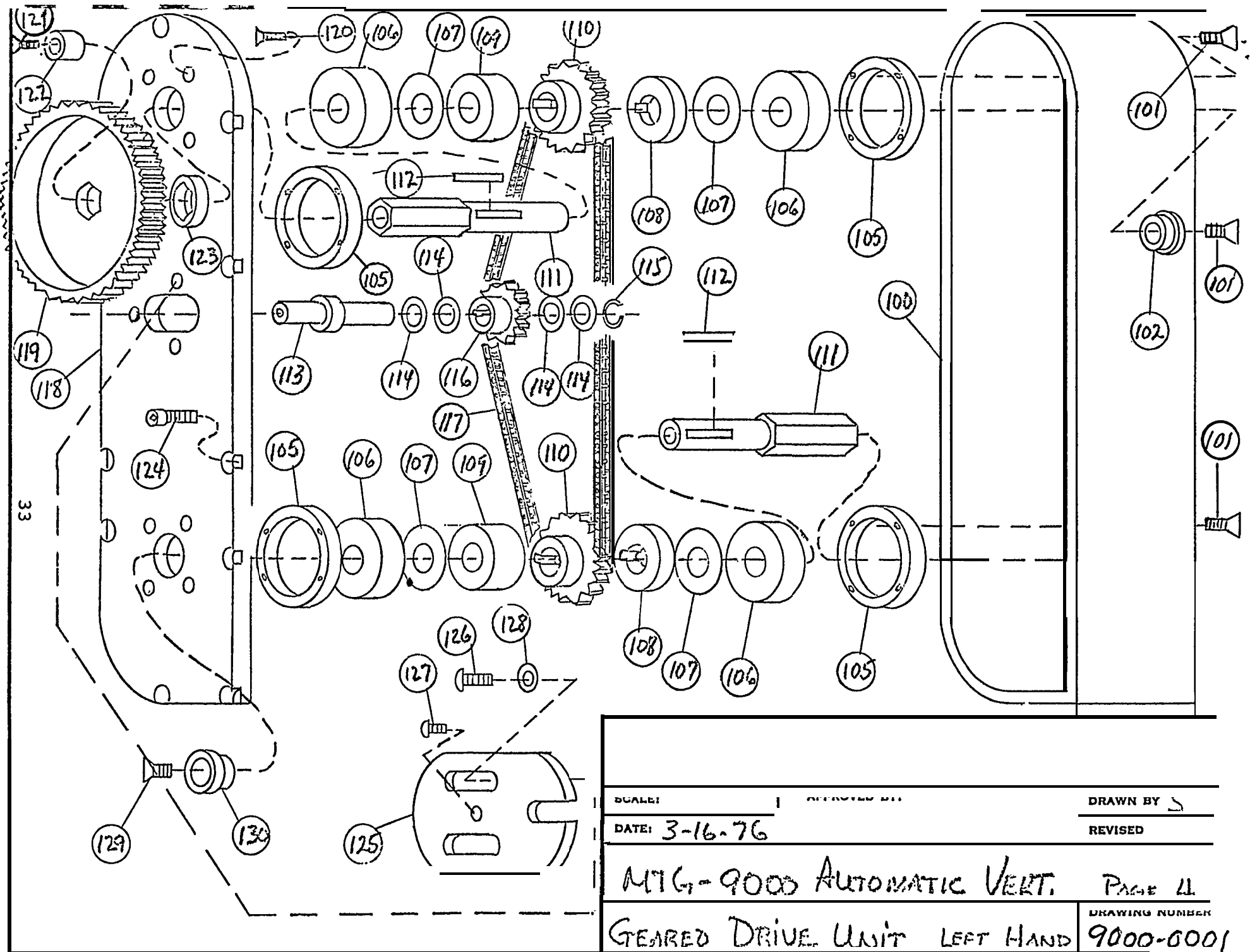
GEARED DRIVE 1017 RIGHT HAND 9000-0001

MTG-9000-0001 MAIN DRIVE UNIT, CLUTCH
ASSEMBLY & GEARED DRIVE UNITS PARTS LIST

SEE DRAWING NO. 9000-0001
Page 3

All Information Above This Line Must Accompany Parts Orders

Part No.	Description	Qty . Reqd.
9000-0001-53	Right hand support arm & drive housing	1
9000-0001-54	Cap screw (6-32 x 1/2 FSCSKSH)	4
9000-0001-55	Tractor drive shaft bearing cap	1
9000-0001-56	Cap Screw (1/4-20 x 1/4 FSCSKSH)	1
9000-0001-57	Screw (6-32 x 3/8 PH)	4
9000-0001-58	1/4" pipe plug	1
9000-0001-59	Bearing ring--small bearing	2
9000-0001-60	Bearing ring--large bearing	1
9000-0001-61	Roller bearing	3
9000-0001-62	Roller bearing	1
9000-0001-63	Standard bearing spacer	3
9000-0001-64	Small bearing spacer	1
9000-0001-65	Main drive bearing spacer	1
9000-0001-66	Internal small bearing drive sprocket	1
9000-0001-67	Internal large bearing drive sprocket	1
9000-0001-68	Main drive bull gear	1
9000-0001-69	Tractor main drive shaft	1
9000-0001-70	1-15/32" shaft key	1
9000-0001-71	Small bearing spacer	1
9000-0001-72	Tractor auxiliary drive shaft	1
9000-0001-73	1" shaft key	1
9000-0001-74	Idler shaft	1
9000-0001-75	Oilite idler spacer	4
9000-0001-76	Idler sprocket	1
9000-0001-77	Retainer ring	1
9000-0001-78	Drive chain	1
9000-0001-79	Right hand support arm cover	1
9000-0001-80	Tractor drive wheel	4
9000-0001-81	Cap screw (6-32 x 1/2 FCSKSH)	4
9000-0001-82	Cap screw (1/4-20 x 1/2 SH)	2
9000-0001-83	Drive wheel cap	1
9000-0001-84	Drive roll spacer	1
9000-0001-85	Cap screw (10-24 x 1/2 SH)	7
9000-0001-86	Motor drive adapter plate	1
9000-0001-87	Idler support bracket	1
9000-0001-88	Flat washer 1/4	3
9000-0001-89	Cap screw (1/4-20 x 3/4 BH)	3
9000-0001-90	Cap screw (10-24 x 1 BH)	1
9000-0001-91	Tractor drive shaft bearing cap	1
9000-0001-92	Cap screw (1/4-20 x 1/2 FCSKSH)	1
9000-0001-93	Cap screw (1/4-20 x 1 FCSKSH)	1
9000-0001-94	Cap screw (10-24 x 1 SH)	4



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MTG-9000 AUTOMATIC VERT. PAGE 11

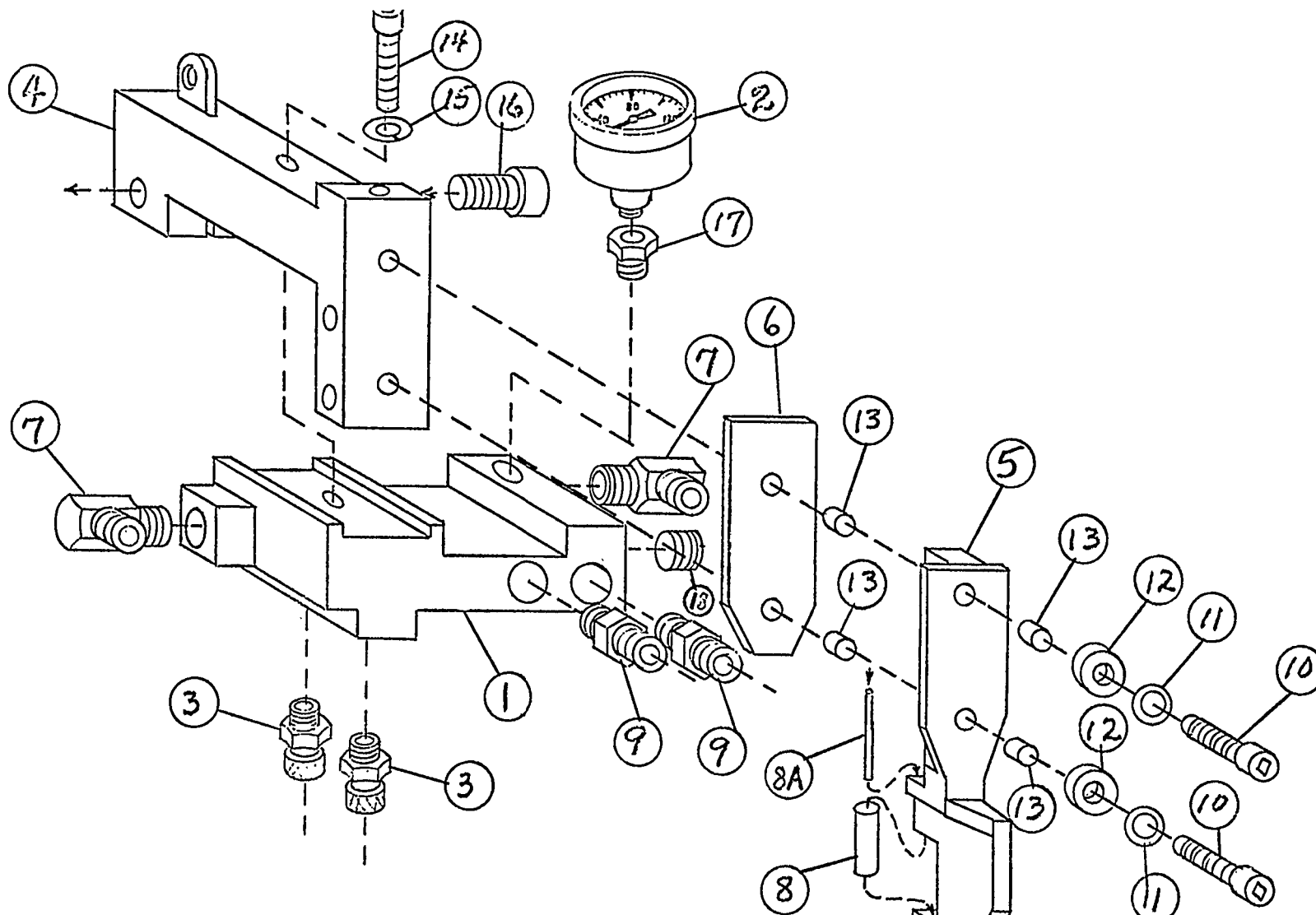
GEARED DRIVE UNIT LEFT HAND DRAWING NUMBER 9000-0001


MTG-9000-0001 MAIN DRIVE UNIT, CLUTCH
ASSEMBLY & GEARED DRIVE UNITS PARTS LIST

SEE DRAWING NO. 9000-0001
Page 4

All Information Above This Line Must Accompany Parts Orders

Part No.	Description	Qty. Reqd.
9000-0001-100	Left hand support arm drive housing	1
9000-0001-101	Cap screw (6-32 x 1/2 FCSKSH)	4
9000-0001-102	Tractor drive shaft bearing cap	1
9000-0001-103	Cap screw (1/4-20 x 1/2 FCSKSH)	1
9000-0001-104	Screw (6-32 x 3/8 PH)	4
9000-0001-105	Bearing ring--small bearing	4
9000-0001-106	Roller bearing	4
9000-0001-107	Standard bearing spacer	4
9000-0001-108	Small bearing spacer	2
9000-0001-109	Internal spacer	2
9000-0001-110	Internal small bearing drive sprocket	2
9000-0001-111	Tractor auxiliary drive shaft	2
9000-0001-112	1" shaft key	2
9000-0001-113	Idler shaft	1
9000-0001-114	Oilite idler spacer	4
9000-0001-115	Retainer ring	1
9000-0001-116	Idler sprocket	1
9000-0001-117	Drive chain	1
9000-0001-118	Left hand support arm cover	1
9000-0001-119	Tractor drive wheel	1
	(Same as 9000-0001-80--Page 3)	1
9000-0001-120	Cap Screw (6-32 x 1/2 FCSKSH)	4
9000-0001-121	Cap screw (1/4-20 x 1/2 SH)	1
9000-0001-122	Drive wheel cap	1
9000-0001-123	Drive roll spacer	1
903G-0001-124	Cap screw (10-24 x 1/2 SH)	11
9000-0001-125	Idler support bracket	1
9000-0001-126	Cap screw (1/4-20 x 3/4 BH)	3
9000-0001-127	Cap screw (10-24 x 1 BH)	1
9000-0001-128	Flat washer 1/4"	3
9000-0001-129	Cap screw (1/4-20 x 1/2 FCSKSH)	1
9000-0001-130	Tractor drive shaft bearing cap	1



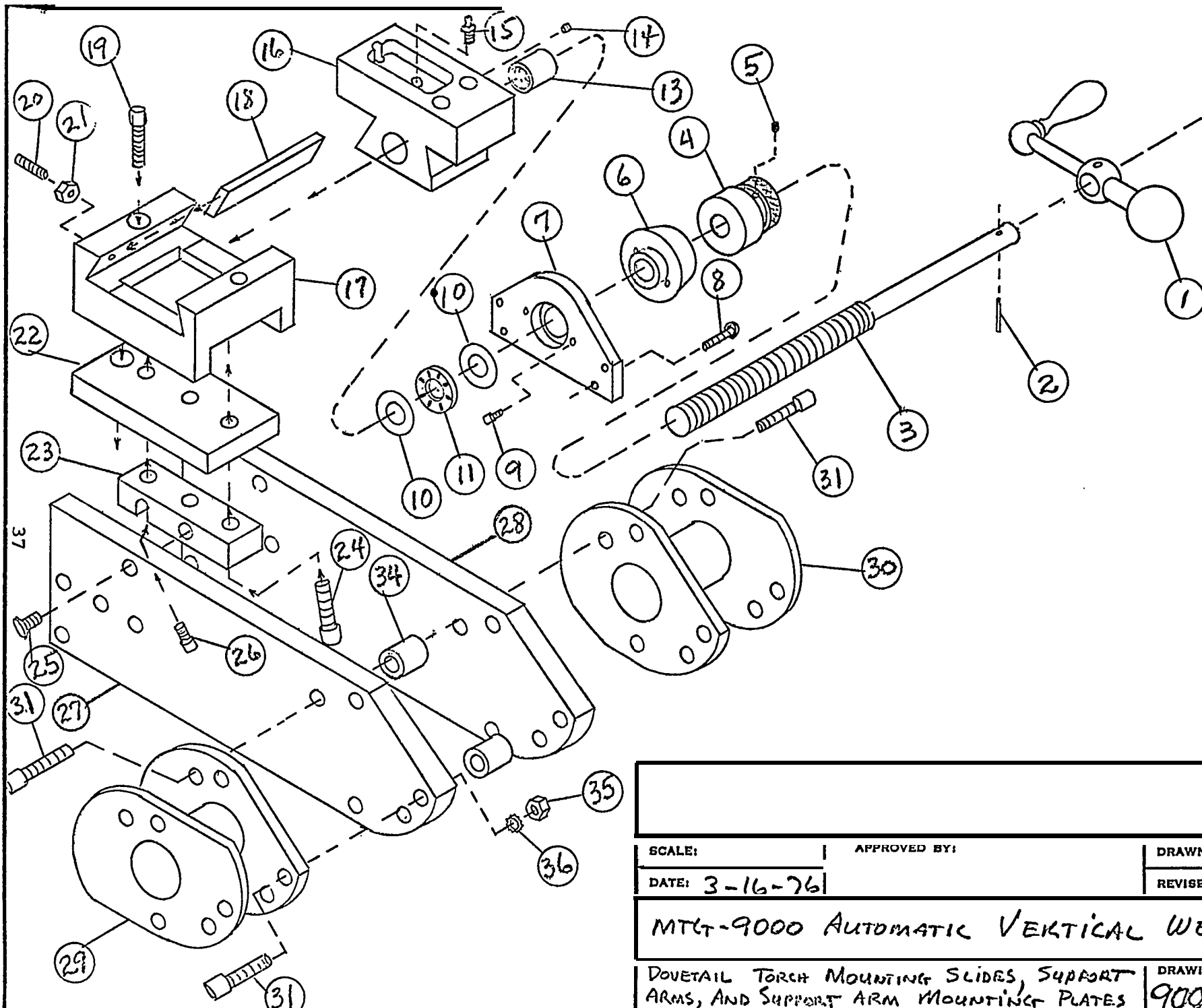
		
SCALE:	DESIGNED BY:	DRAWN BY S. O.
DATE: 3-16-76		REVISED
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INDICATED WATER MOUNTING MOUNTING UNIT WITH TOP PLATE GUIDE		DRAWING NUMBER 9000-0002

MTG-9000-0002 INSULATED WATER MANIFOLD MOUNTING
UNIT WITH TOP PLATE GUIDE PARTS LIST

SEE DRAWING NO. 9000-0002

All Information Above This Line Must Accompany Parts Orders

Part No.	Description	Qty. Reqd.
9000-0002-1	water manifold	1
9000-0002-2	Gauge	1
9000-0002-3	Quick disconnect water fitting	2
9000-0002-4	Reel arm socket	1
9000-0002-5	Front guide arm	1
9000-0002-6	Guide arm insulator	1
9000-0002-7	90° elbow water fitting	2
9000-0002-8	Guide-roller with bushing (specify root opening)	1
9000-0002-8A	Roller pin	1
9000-0002-9	Straight water fitting	2
9000-0002-10	Cap screw (1/4-20 x 1 SH)	2
9000-0002-11	Flat washer 1/4"	2
9000-0002-12	Insulator washer	2
9000-0002-13	Tube insulator	4
9000-0002-14	Cap screw (1/4-20 x 1 1/2 SH)	1
9000-0002-15	Lock washer 1/4"	1
9000-0002-16	Cap screw (3/8-16 x 1 SH)	1
9000-0002-17	1/4 x 1/8 Galv. bushing	1
9000-0002-18	1/4" pipe plug	1



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MTCT-9000 AUTOMATIC VERTICAL WELDER

*DOVETAIL TORCH MOUNTING SLIDES, SUPPORT
ARMS, AND SUPPORT ARM MOUNTING PLATES*

DRAWING NUMBER
9000-0003

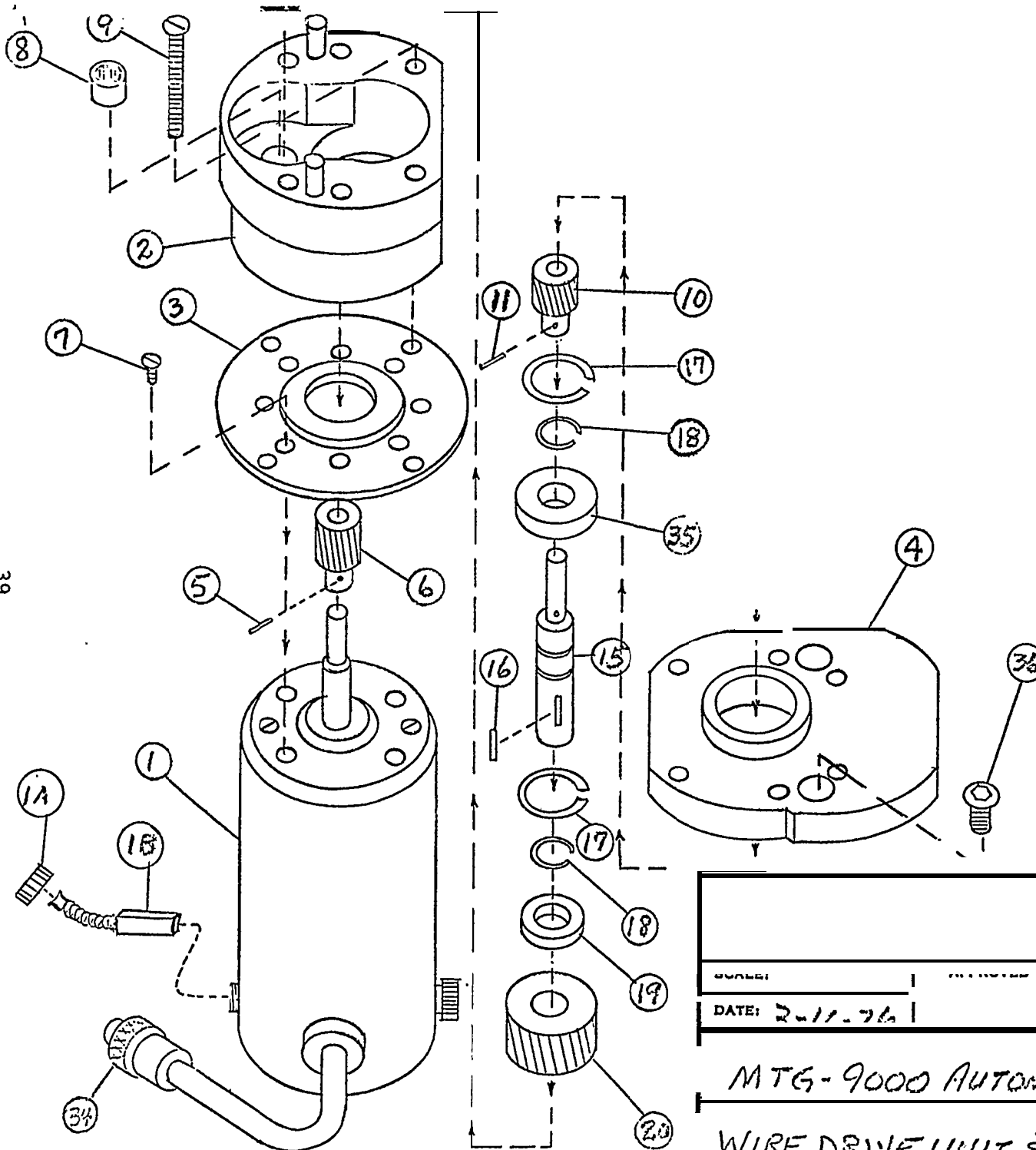
MTG-9000-0003 DOVETAIL TORCH MOUNTING SLIDES, SUPPORT
ARMS, AND SUPPORT ARM MOUNTING PLATES PARTS LIST

SEE DRAWING NO. 9000-0003

All Information Above This Line Must Accompany Parts Orders

Part No.	Description	Qty. Reqd.
9000-0003-1	Cross slide handle	1
9000-0003-2	1/8" x 1" Shaft pin	1
9000-0003-3	Cross slide adjusting screw	1
9000-0003-4	Knurled set collar	1
9000-0003-5	Set screw (10-24 x 1/4)	1
9000-0003-6	Oilite bushing mount	1
9000-0003-7	End bracket	1
9000-0003-8	Cap screw (10-24 x 5/8 BH)	4
9000-0003-9	Cap screw (6-32 x 1/4 SH)	2
9000-0003-10	Thrust race	2
9000-0003-11	Roller thrust bearing	1
9000-0003-13	Threaded oilite bushing	1
9000-0003-14	Set screw (10-24 x 1/4)	1
9000-0003-15	Grease fitting	1
9000-0003-16	Slide	1
9000-0003-17	Base	1
9000-0003-18	Gibb	1
9000-0003-19	Cap screw (1/4-20 x 1 1/2 SH)	1
9000-0003-20	Set screw half dog point (10-32 x 1")	2
9000-0003-21	Nut 10-32	2
9000-0003-22	Cross slide block adapter plate	1
9000-0003-23	Cross slide mount	1
9000-0003-24	Cap screw (1/4-20 x 3/4 SH)	1
9000-0003-25	Cap screw (1/4-20 x 1 FCSKSH)	2
9000-0003-26	Cap screw (1/4-20 x 1/2 SH)	2
9000-0003-27	Left hand guide and feed head insulated support arm	1
9000-0003-28	Right hand guide and feed head insulated support arm	1
9000-0003-29	Left hand support arm mounting plate	1
9000-0003-30	Right hand support arm mounting plate	1
9000-0003-31	Cap screw (1/4-20 x 1" SH)	10
9000-0003-34	Head mounting insulated spacer	2
9000-0003-35	Nut 1/4-20	8
9000-0003-36	1/4" star washer	8

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MTG-9000 AUTOMATIC VERTICAL WELDER
 WIRE DRIVE UNIT STOPPED ASSEMBLY
 9000-0004

PAGE 1

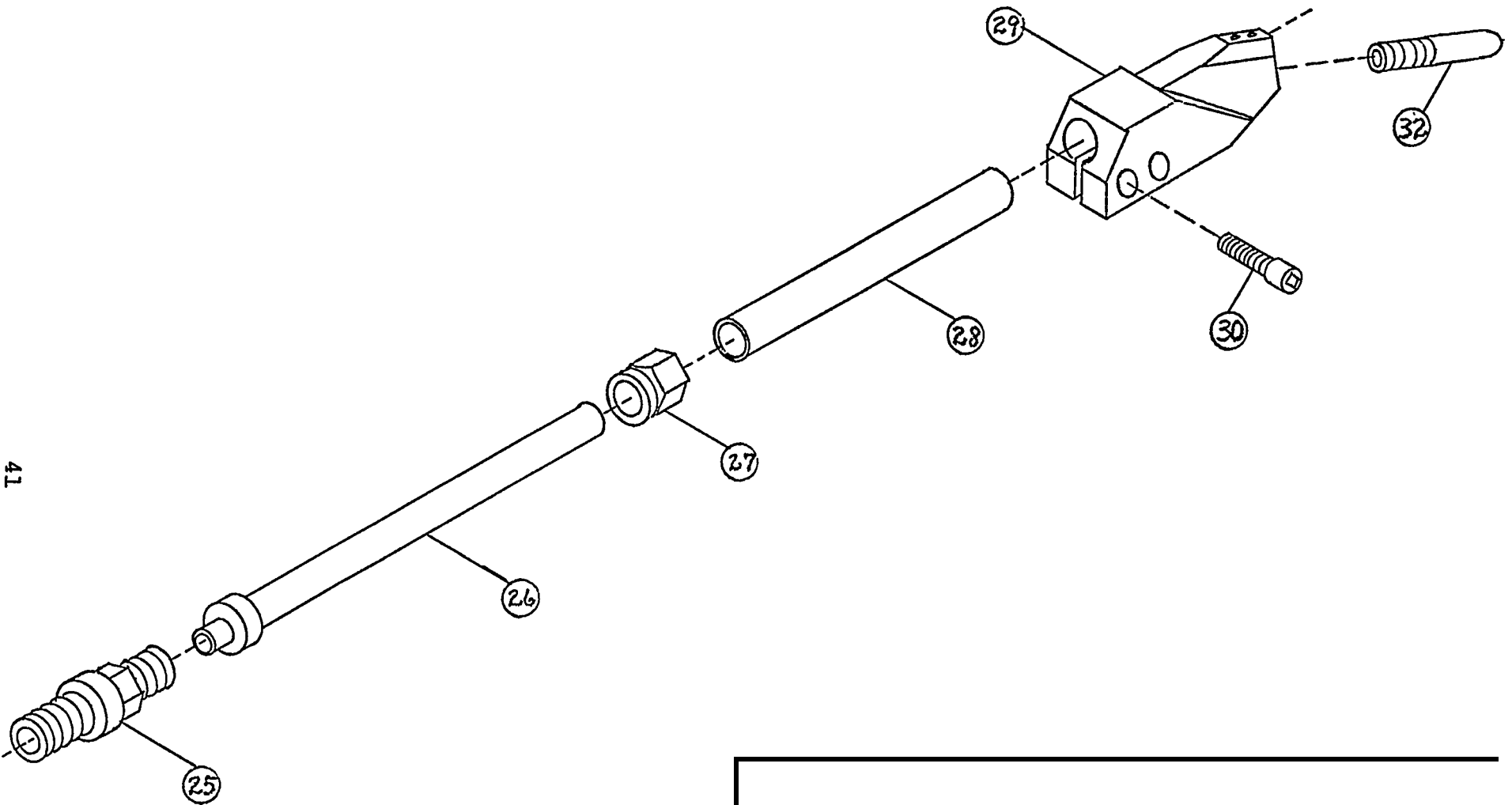
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MTG-9000-0004 WIRE DRIVE UNIT & TORCH ASSEMBLY PARTS LIST

See Drawing No. 9000-0004
Page 1

All Information Above This Line Must Accompany Parts Orders

Part No.	Description	Qty. Reqd.
9000-0004-1	Wire drive motor	1
9000-0004-1A	Brush cap	2
9000-0004-1B	Brush	2
9000-0004-2	Auxiliary gear housing	1
9000-0004-3	Motor adapter plate	1
9000-0004-4	Auxiliary gear housing cover	1
9000-0004-5	1/16 x 3/8 shaft pin	1
9000-0004-6	17 tooth pinion	1
9000-0004-7	Screw (6-32 x 3/8 FCSK)	4
9000-0004-8	Needle bearing	1
9000-0004-9	Screw (8-32 x 1-3/4 FCSK)	4
9000-0004-10	10 tooth pinion	1
9000-0004-11	1/16 x 3/8 shaft pin	1
9000-0004-15	Auxiliary drive shaft	1
9000-0004-16	1/8 x 1/2 woodruff key	1
9000-0004-17	Retainer ring	2
9000-0004-18	Retainer ring	2
9000-0004-19	Gear spacer	1
9000-0004-20	34 tooth gear	1
9000-0004-34	4 pin male plug	1
9000-0004-35	Bearing	1
9000-0004-36	Screw (1/4 -20 x 3/4 FCSKSH)	2



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3-16-76

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S.D.

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MTG-9000 AUTOMATIC VERTICAL WELDER PAGE 2

DRAWING NUMBER

WIRE DRIVE UNIT & TOUCH ASSEMBLY

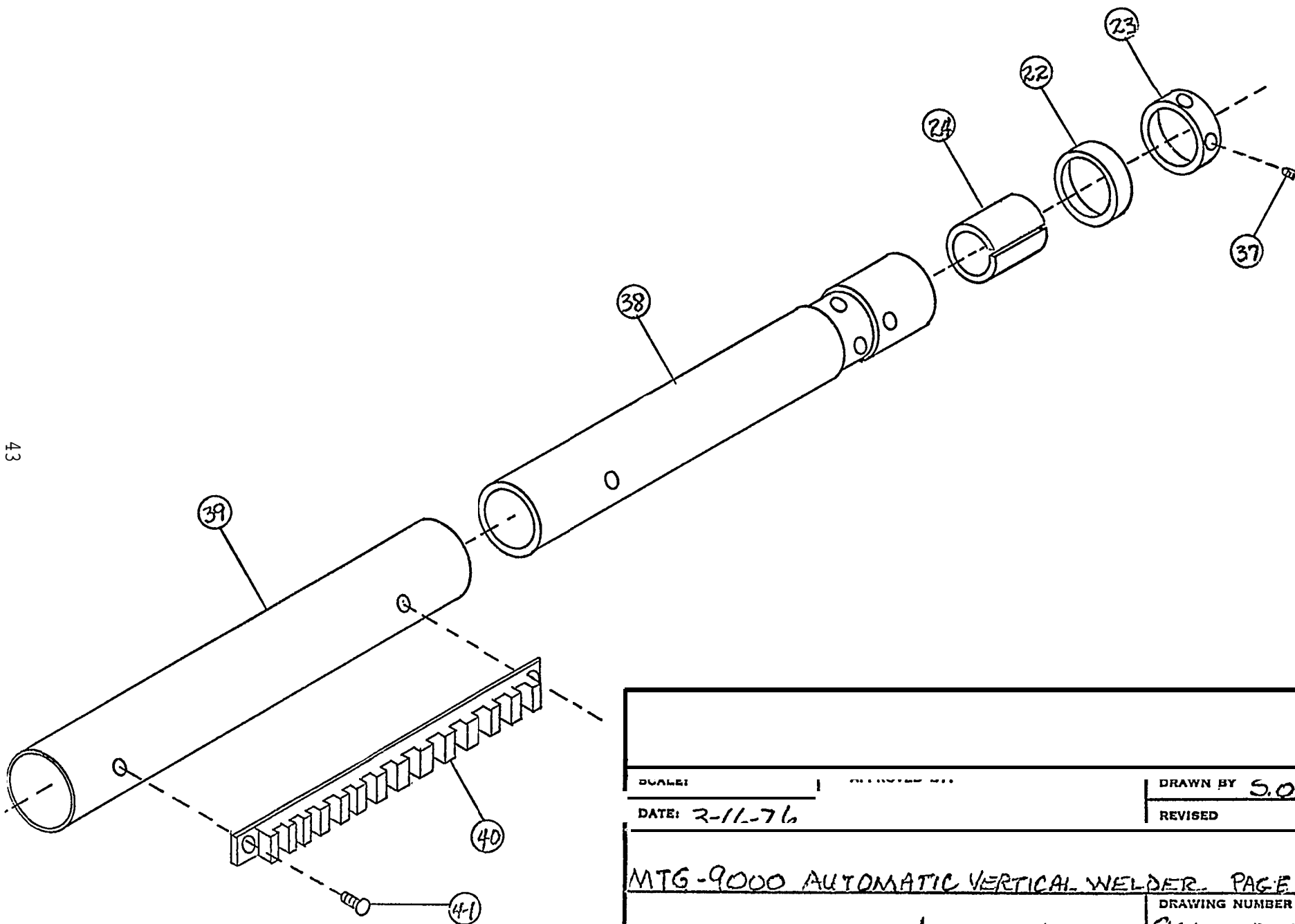
9000-0004

MTG-9000-0004 WIRE DRIVE UNIT & TORCH ASSEMBLY PARTS LIST

SEE DRAWING NO. 9000-0004
Page 2

All.1 Information Above This Line Must Accompany Parts Orders

Part No.	Description	Qty. Reqd.
9000-0004-25	Short barrel extension	1
9000-0004-26	Long barrel extension	1
9000-0004-27	Nozzle lock nut	1
9000-0004-28	Long barrel extension insulator	1
9000-0004-29	Tip guide	1
9000-0004-30	Cap screw (1/4-20 x 3/4 SH)	2
9000-0004-32	Vertical electro slag tip	1



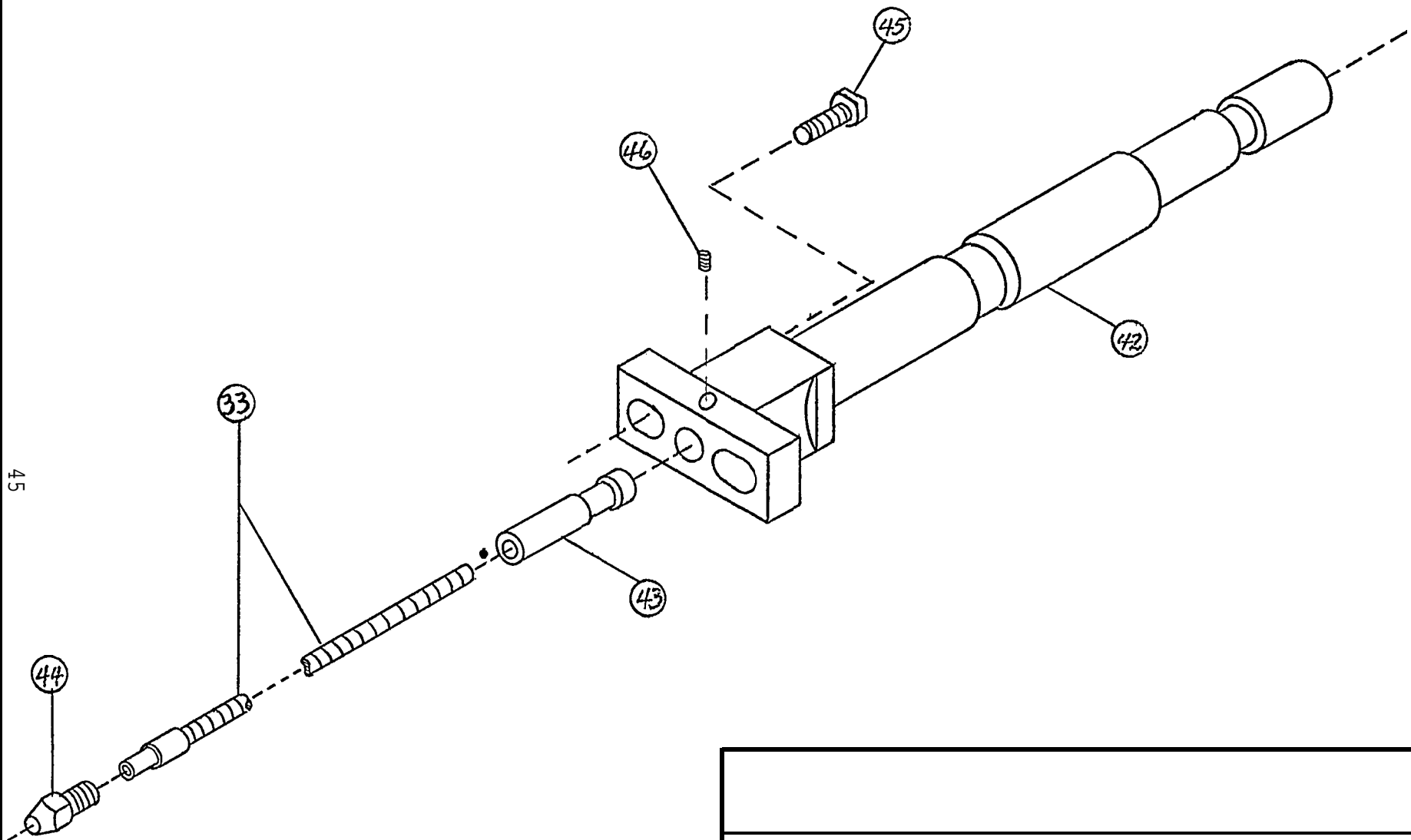
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DATE: 2-11-76		REVISED	
MTG-9000 AUTOMATIC VERTICAL WELDER. PAGE 3			
WIRE DRIVE UNIT & TORCH ASSY.		DRAWING NUMBER 9000-0004	

MTG-9000-0004 WIRE DRIVE UNIT & TORCH **ASSEMBLY PARTS LIST**

SEE DRAWING NO. 9000-0004
Page 3

ALL Information Above This Line Must Accompany Parts Orders

Part No.	Description	Qty. Reqd.
9000-0004-22	Barrel insulating washer--bottom	1
9000-0004-23	Barrel lock collar	1
9000-0004-24	Barrel insulating sleeve bottom	1
9000-0004-37	et screw (8-32 x ¼)	2
9000-0004-38	Inner barrel-insulator	1
9000-0004-39	Outer barrel	1
9000-0004-40	Outer barrel rack	1
9000-0004-41	Screw (6-32 x ¼ PHST)	2



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FIGURE 1
 MTG-9000 AUTOMATIC VERTICAL WELDER

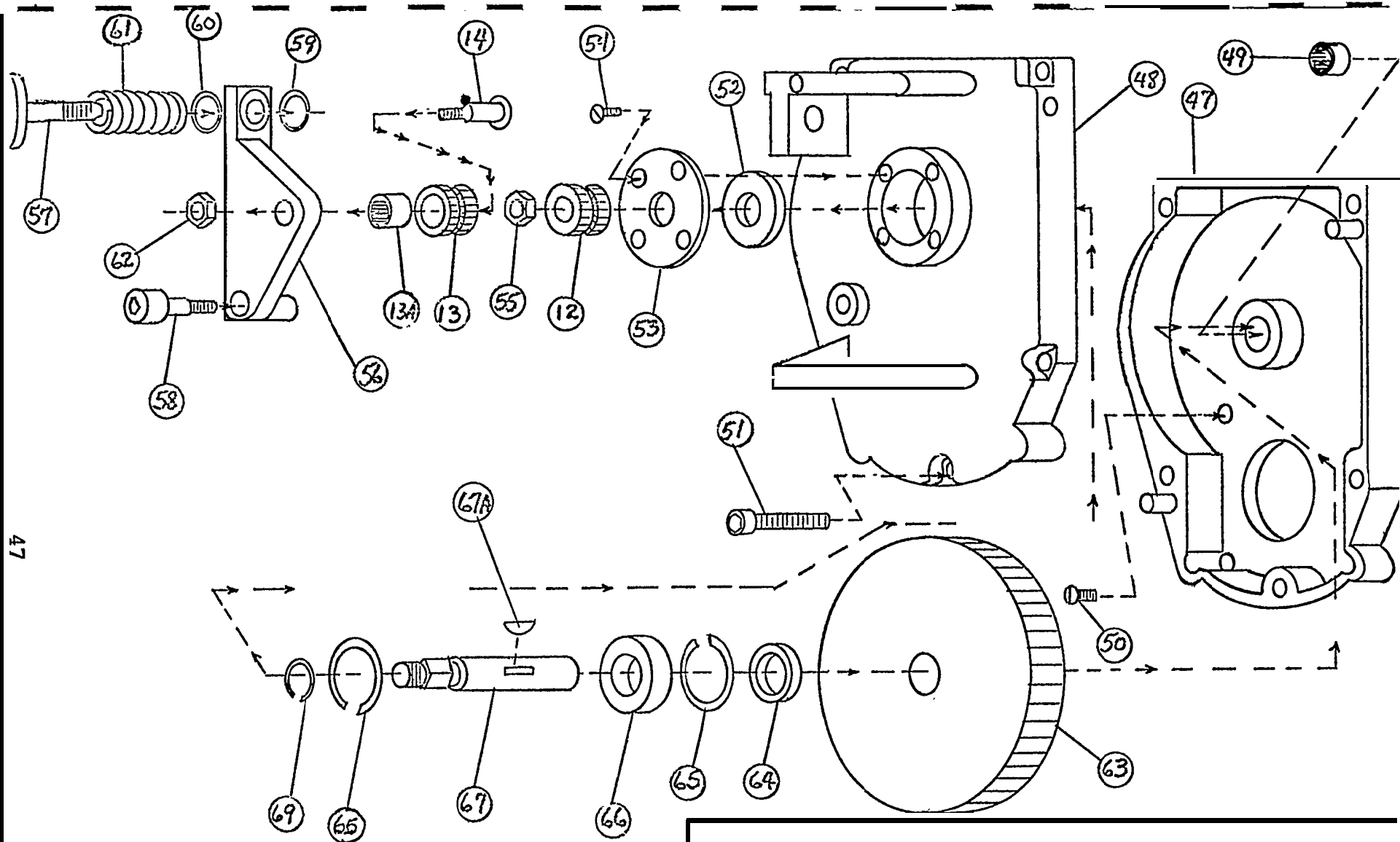
WIDE DRIVE UNIT & TIG WELDING	DRAWING NUMBER 9000-004
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MTG-9000-0004 WIRE DRIVE UNIT & TORCH ASSEMBLY PARTS LIST

SEE DRAWING NO. 9000-0004
Page 4

All Information Above This Line Must Accompany Parts Orders

Part No.	Description	Qty. Reqd.
9000-0004-33	Wire liner with retainer	1
9000-0004-42	Inner barrel	1
9000-0004-43	Wire guide	1
9000-0004-44	Inlet guide	1
9000-0004-45	Cap screw (5/16-18 x 1 Hex)	2
9000-0004-46	Set screw (1/4-20 x 3/8)	1



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DATE: 3-16-76

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PAGE 5

MTG-9000 AUTOMATIC VERTICAL WELDER

DRAWING NUMBER

WIRE DRIVE UNIT & TORCH ASSY.

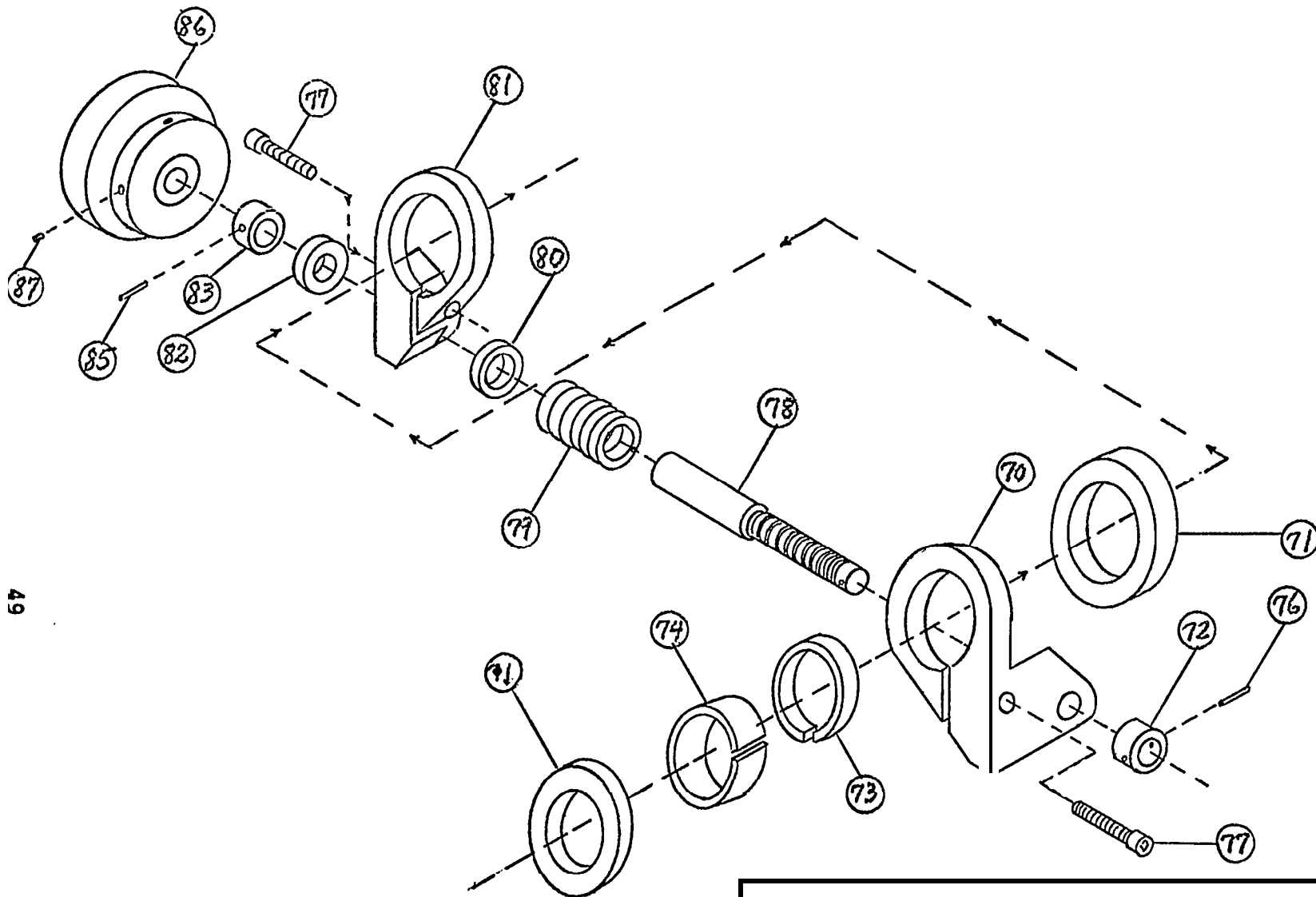
9000-004

MTG-9000-0004 WIRE DRIVE UNIT & TORCH ASSEMBLY PARTS LIST

SEE DRAWING NO. 9000-0004
Page 5

All Information Above This Line Must Accompany Parts Orders

Part No.	Description	Qty. Reqd.
9000-0004-12	3/32" wire drive roll	1
9000-0004-13	3/32" wire idler roll	1
9000-0004-13A	Idler roll bearing	1
9000-0004-14	Idler roll bearing shaft	1
9000-0004-47	Bottom wire drive gear housing	1
9000-0004-48	Top wire drive gear housing	1
9000-0004-49	Needle bearing	1
9000-0004-50	Screw (8-32 x 1/2 FCSK)	4
9000-0004-51	Cap screw (1/4-20 x 1 SH)	5
9000-0004-52	Felt washer	1
9000-0004-53	Bearing cap	1
9000-0004-54	Screw (8-32 x 3/8 FCSK)	4
9000-0004-55	Drive roll nut 3/8-24 Special	1
9000-0004-56	Idler roll swivel bracket	1
9000-0004-57	Idler roll bracket tension screw	1
9000-0004-58	Shoulder screw for swivel bracket	1
9000-0004-59	Idler roll bracket tension screw keeper	1
9000-0004-60	Swivel bracket shim	1
9000-0004-61	Idler roll bracket tension spring	1
9000-0004-62	Nut 1/4-28	1
9000-0004-63	Wire drive bull gear	1
9000-0004-64	Gear spacer	1
9000-0004-65	Retainer ring	2
9000-0004-66	Bearing	1
9000-0004-67	Drive shaft	1
9000-0004-67A	1/2 x 3/32 woodruff key	1
9000-0004-69	Retainer ring	1



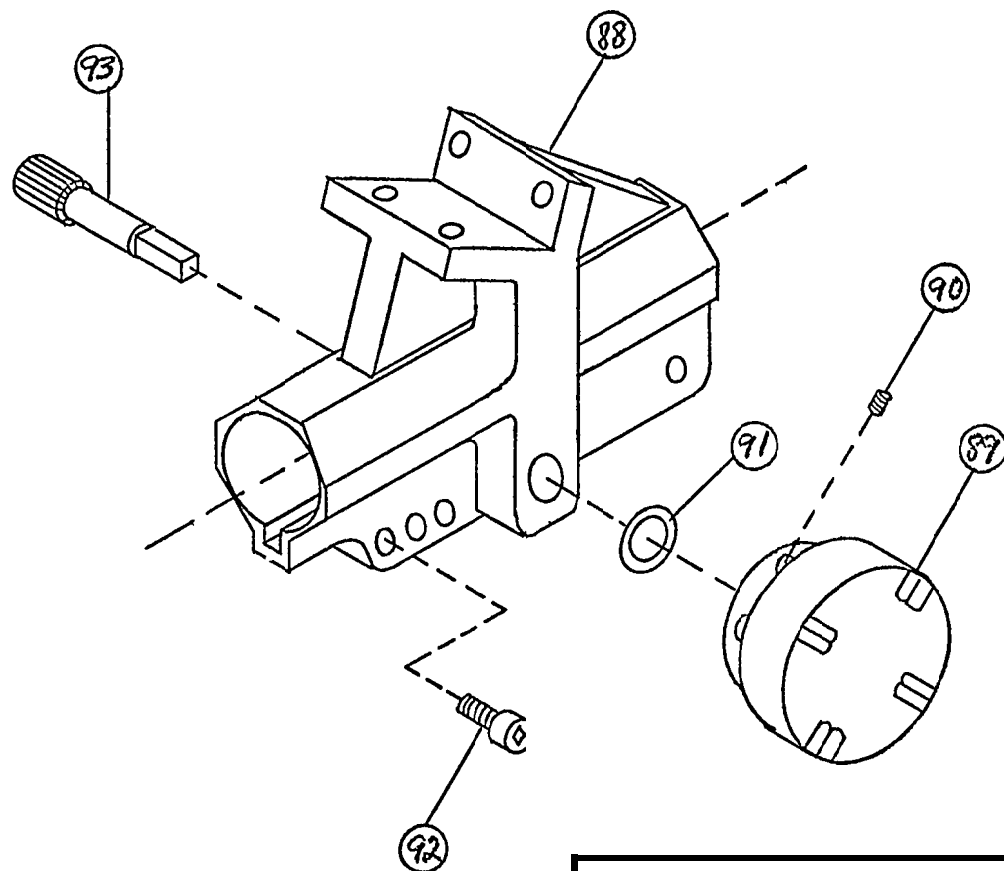
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DATE: 3-16-76		REVISED
MTG-9000 AUTOMATIC VERTICAL WELDER		PAGE 6
WIRE DRIVE UNIT & TOP ASSEMBLY		DRAWING NUMBER 9000-0004

MTG-9000-0004 WIRE DRIVE UNIT & TORCH ASSEMBLY PARTS LIST

SEE DRAWING NO. 9000-0004
Page 6

All Information Above This Line Must Accompany Parts Orders

Part No.	Description	Qty . Req d.
9000-0004-70	Upper rotation arm	1
9000-0004-71	Barrel insulator washer--top	2
9000-0004-72	Rotation limit collar	1
9000-0004-73	Rotation adjustment clamping sleeve	1
9000-0004-74	Rotation adjustment insulating sleeve	1
9000-0004-76	3/32 x 1/2 shaft pin	1
9000-0004-77	Cap screw (8-32 x 1-1/8" SH)	2
9000-0004-78	Rotation adjustment screw	1
9000-0004-79	Rotation adjustment spring	1
9000-0004-80	1/16 Thrust washer	1
9000-0004-81	Lower rotation arm	1
9000-0004-82	1/8 Thrust washer	1
9000-0004-83	Thrust collar	1
9000-0004-85	3/32 x 5/8 shaft pin	1
9000-0004-86	Rotation adjustment knob	1
9000-0004-87	Set screw (8-32 x 1/4)	2



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DATE: 3-16-76

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MTG-9000 AUTOMATIC VERTICAL WELDER

PAGE 1

DRAWING NUMBER,

WELDER ASSEMBLY - 9000-0000

9000-0000

MTG-9000-0004 WIRE DRIVE UNIT & TORCH ASSEMBLY PARTS LIST

SEE DRAWING NO. 9000-0004
Page 7

All Information Above This Line Must Accompany Parts Orders

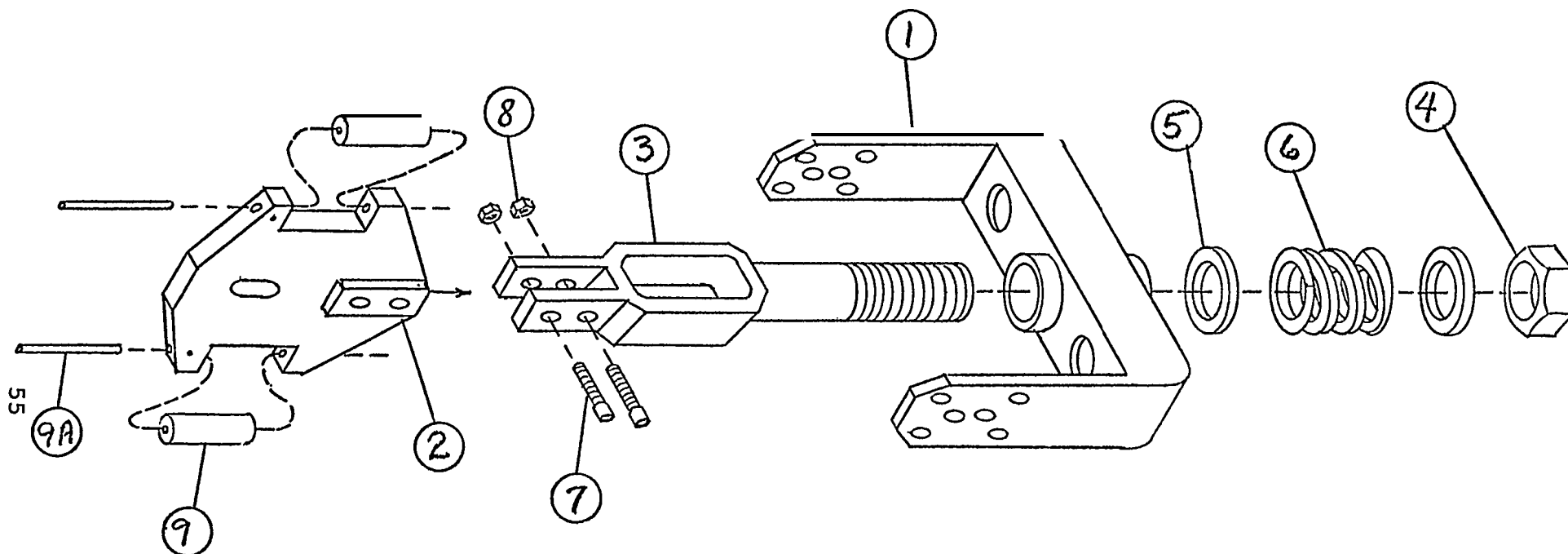
Part No.	Description	Qty. Reqd.
9000-0004-88	Torch guide bracket	1
9000-0004-89	Torch guide bracket knob	1
9000-0004-90	Set screw (8-32 x ¼)	2
9000-0004-91	Oilite thrust washer	1
9000-0004-92	Cap screw (¼-20 x ½ SH)	2
9000-0004-93	Torch rack gear	1

MTG-9000-0005 WIRE STRAIGHTENER UNIT PARTS LIST

SEE DRAWING NO. 9000-0005

All Information Above This Line Must Accompany Parts Orders

Part No.	Description	Qty. Reqd.
9000-0005-1	Wire straightener adapter	1
9000-0005-2	Wire straightener body assembly	1
9000-0005-3	Adjustment screw	1
9000-0005-4	Adjustment block	1
9000-0005-5	clamp	1
9000-0005-6	Cap screw (5/16-18 x 1 Hex)	2
9000-0005-7	5/16 flat washer	2
9000-0005-8	Cap screw (1/4-20 x 1 SH)	1
9000-0005-9	1/4 flat washer	1
9000-0005-10	Tension roller	1
9000-0005-11	5/16 Flat washer	1
9000-0005-12	Nut 1/4-20	1
9000-0005-13	1/4 lock washer	1
9000-0005-14	Adjustment screw shim	1
9000-0005-15	Nut 5/16-18	1
9000-0005-16	Wire Guide	1



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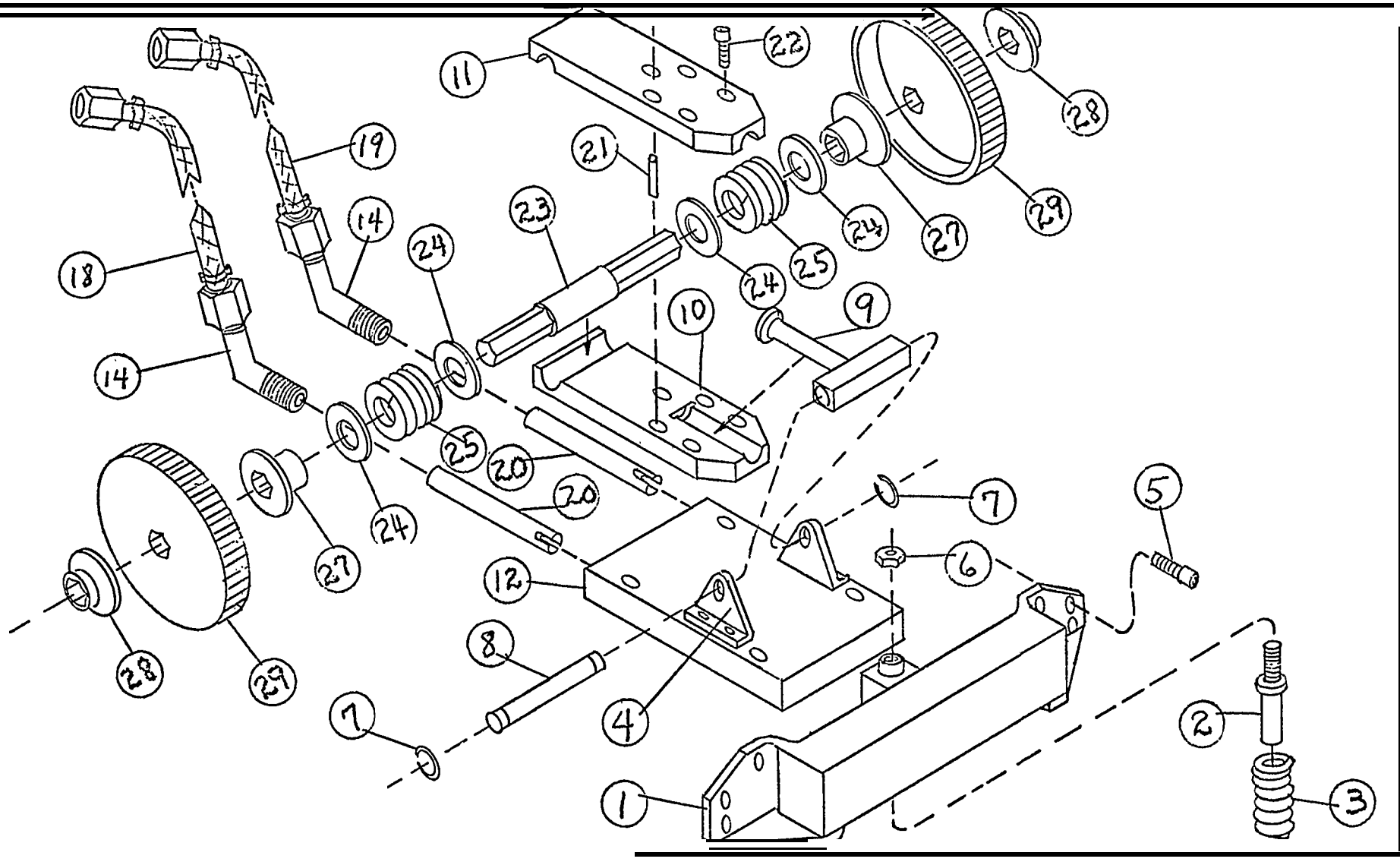
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DRAW BOLT GUIDE, DRAW BOLT & DRAW BOLT GUIDE	9000-0006

MTG-9000-0006 DRAW BOLT GUIDE, DRAW BOLT
AND PLATE GUIDE ASSEMBLY PARTS LIST

SEE DRAWING NO. 9000-0006

All Information Above This Line Must Accompany Parts Orders

Part No.	Description	Qty. Reqd.
9000-0006-1	Draw bolt guide	1
9000-0006-2	Tie plate assembly	1
9000-0006-3	Draw bolt	1
9000-0006-4	Draw bolt nut	1
9000-0006-5	Draw bolt washer	2
9000-0006-6	Draw bolt spring	1
9000-0006-7	Cap screw ($\frac{1}{4}$ -20 x $1\frac{1}{4}$ SH)	2
9000-0006-8	Nut $\frac{1}{4}$ -20	2
9000-0006-9	Guide roller with bushing (specify root opening)	2
9000-0006-9A	Roller pin	2



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DATE: 2-16-76

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MTG 9000 AUTOMATIC VERTICAL WELDER PAGE. 1
 FRONT & REAR SHOE WATER COOLING
 SYSTEM AND MOUNTING UNITS

WARRANTY NUMBER:
 9000-0007

MTG-9000-0007 FRONT AND REAR SHOE WATER COOLING
SYSTEM AND MOUNTING UNIT PARTS LIST

SEE DRAWING NO. 9000-0007
Pages 1 & 2

All Information Above This Line Must Accompany Parts Orders

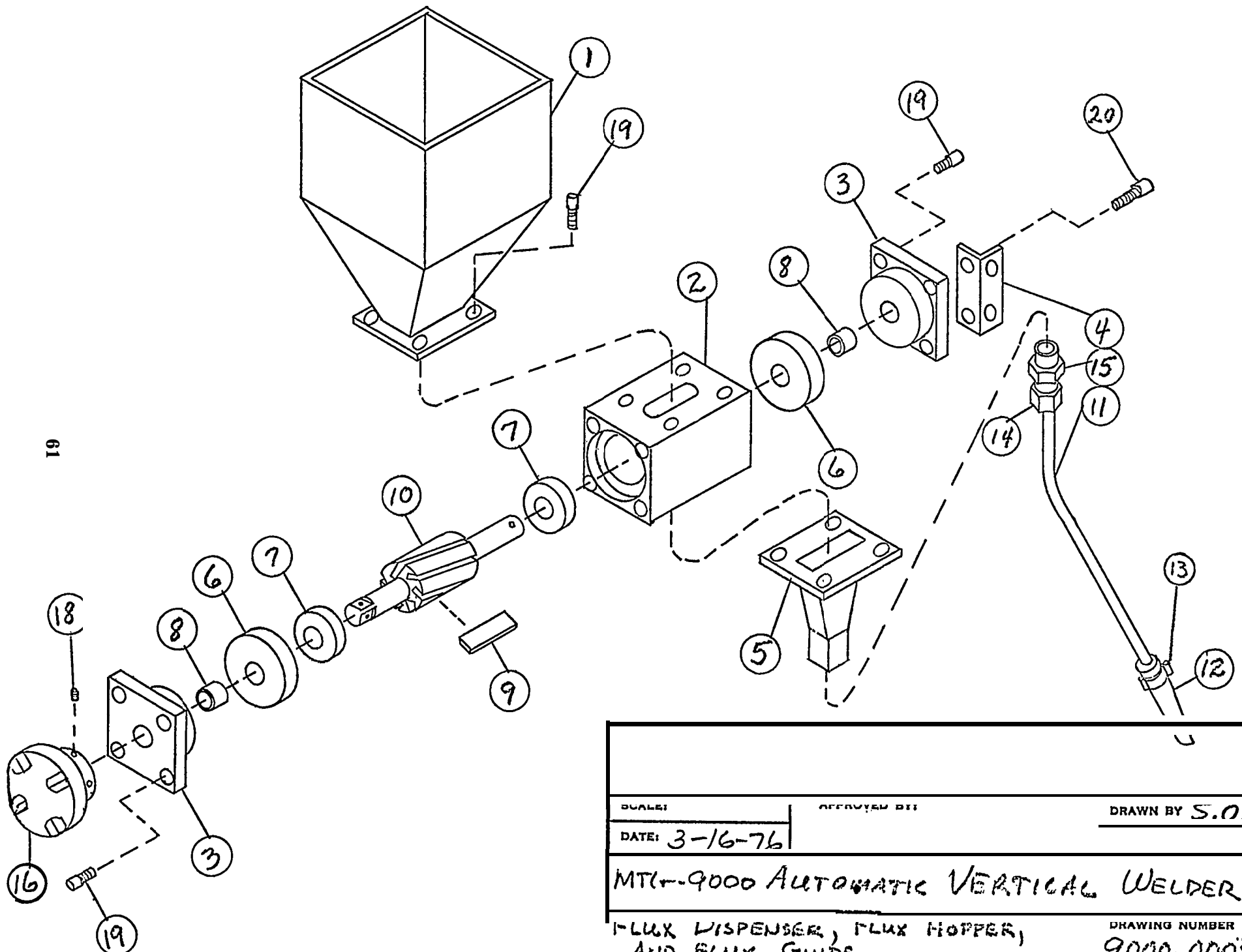
Part No.	Description	Qty. Reqd.
9000-0007-1	Bottom cross tie member	1
9000-0007-2	Front shoes tension adjusting bolt	1
9000-0007-3	Front shoe tension spring	1
9000-0007-4	Front shoe pivot pin mount	2
9000-0007-5	Cap screw ($\frac{1}{4}$ -20 x $\frac{3}{4}$ SH)	10
9000-0007-6	Tension bolt lock nut	1
9000-0007-7	Retainer ring	2
9000-0007-8	Front shoe pivot pin	1
9000-0007-9	Pivot arm	1
9000-0007-10	Front shoe pivot bracket--bottom	1
9000-0007-11	Front shoe pivot bracket--top	1
9000-0007-12	Front shoe	1
9000-0007-13	Rear shoe	1
9000-0007-14	Front shoe 45° elbow water fitting	2
9000-0007-15	Rear shoe 90° elbow water fitting	2
9000-0007-16	Rear shoe water return tube with fittings	1
9000-0007-17	Rear shoe water inlet tube with fittings	1
9013-0007-18	Front shoe water return tube with fittings	1
9000-0007-19	Front shoe water inlet tube with fittings	1
9000-0007-20	Cooling tube	4
9000-0007-21	3/16 x 5/8 dowel pin	2
9000-0007-22	Cap screw (10-24 x 5/8 SH)	3
9000-0007-23	Rear axle shaft	1
9000-0007-24	Oilite spacer	4
9000-0007-25	Rear axle shaft tension spring	2
9000-0007-27	Drive roll spacer (long)	2
9000-0007-28	Drive roll spacer (short)	2
9000-0007-29	Tractor drive wheel (same as 9000-0001-80 Page 3)	2
9000-0007-30	Rear carrier	1
9000-0007-31	Shoulder bolt ($\frac{1}{2}$ x $\frac{1}{2}$)	4
9000-0007-32	Rear carrier bearing wheel	4
9000-0007-33	Tie plate pin	1
9000-0007-34	1/16 spacer	4
9000-0007-35	Rear shoe guide arm	1
9000-0007-36	Guide roller with bushing (specify root opening)	1
9000-0007-36A	Roller pin	
9000-0007-37	Cap screw (10-24 x $\frac{1}{2}$ SH)	1
5000-0007-38	Right hand rear shoe support arm	1
9000-0007-39	Left hand rear shoe support arm	1

MTG-9000-0007 FRONT AND REAR SHOE WATER COOLING
SYSTEM AND MOUNTING UNIT PARTS LIST

SEE DRAWING NO. 9000-0007
Pages 1 & 2

All Information Above This Line Must Accompany Parts Orders

Part No.	Description	Qty. Reqd.
9000-0007-40	Support arm spacer	2
5000-0007-41	Support arm tie bar	1
9000-0007-42	Cap screw (8-32 x 3/4 SH)	2
9000-0007-43	Rear shoe to support arm bracket	2
9000-0007-44	Rear shoe tension spring	2
9000-0007-45	Cap screw (1/4-20 x 1/2 FCSKSH)	6
9000-0007-46	Cap screw (1/4-20 x 1 FCSKSH)	4



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MT-9000 AUTOMATIC VERTICAL WELDER

FLUX DISPENSER, FLUX HOPPER,
AND WIRE GUIDE

DRAWING NUMBER

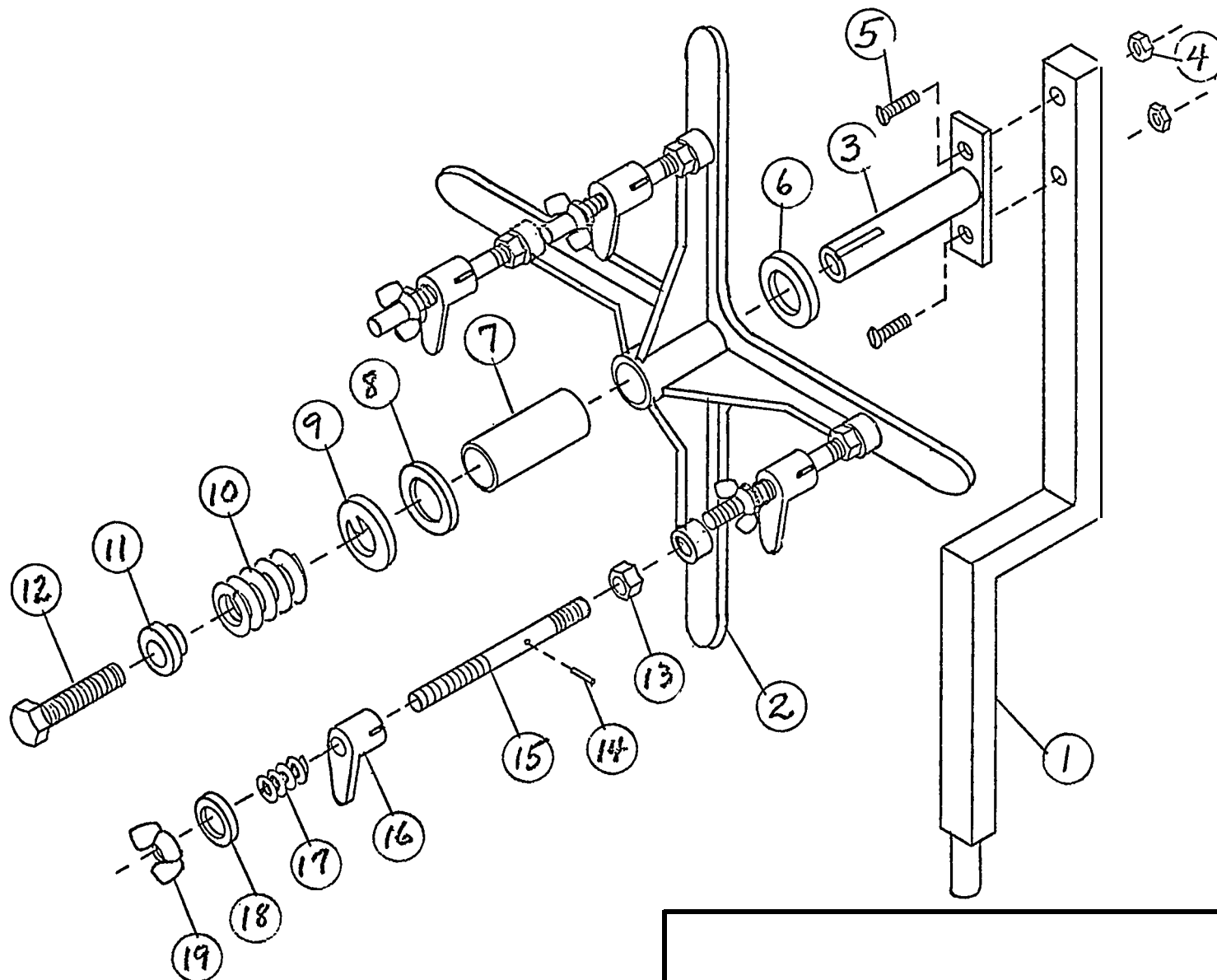
9000-0008

MTG-9000-0008 FLUX DISPENSER, FLUX
HOPPER , AND FLUX GUIDE PARTS LIST

SEE DRAWING NO. 9000-0008

All Information Above This Line Must Accompany Parts Orders

Part No.	Description	Qty . Reqd.
9000-0008-1	Flux dispenser hopper	1
9000-0008-2	Flux dispenser body	1
9000-0008-3	Flux dispenser cap	2
9000-0008-4	Flux dispenser mounting bracket	1
9000-0008-5	Dispenser Funnel	1
9000-0008-6	Cap washer	2
9000-0008-7	Rotor washer	2
9000-0008-8	Oilite bushing	2
9000-0008-9	Rotor blade	6
9000-0008-10	Flux dispenser rotor	1
9000-0008-11	Flux feed tube	1
9000-0008-12	Flux tube insulated end	1
9000-0008-13	1/2 " tube clamp	1
9000-0008-14	Feed tube retainer nut & ferrule	1
9000-0008-15	Tube to funnel adapter	1
9000-0008-16	Knob	1
9000-0008-18	Set screw (8-32 X ¼)	2
9000-0008-19	Cap screw (10-24 X ½ SH)	14
9000-0008-20	Cap screw (10-24 x 5/8 SH)	2



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DATE: 2-11-71

MTC-9000 AUTOMATIC VERTICAL WELDER

WIRE REEL MOUNTING UNIT

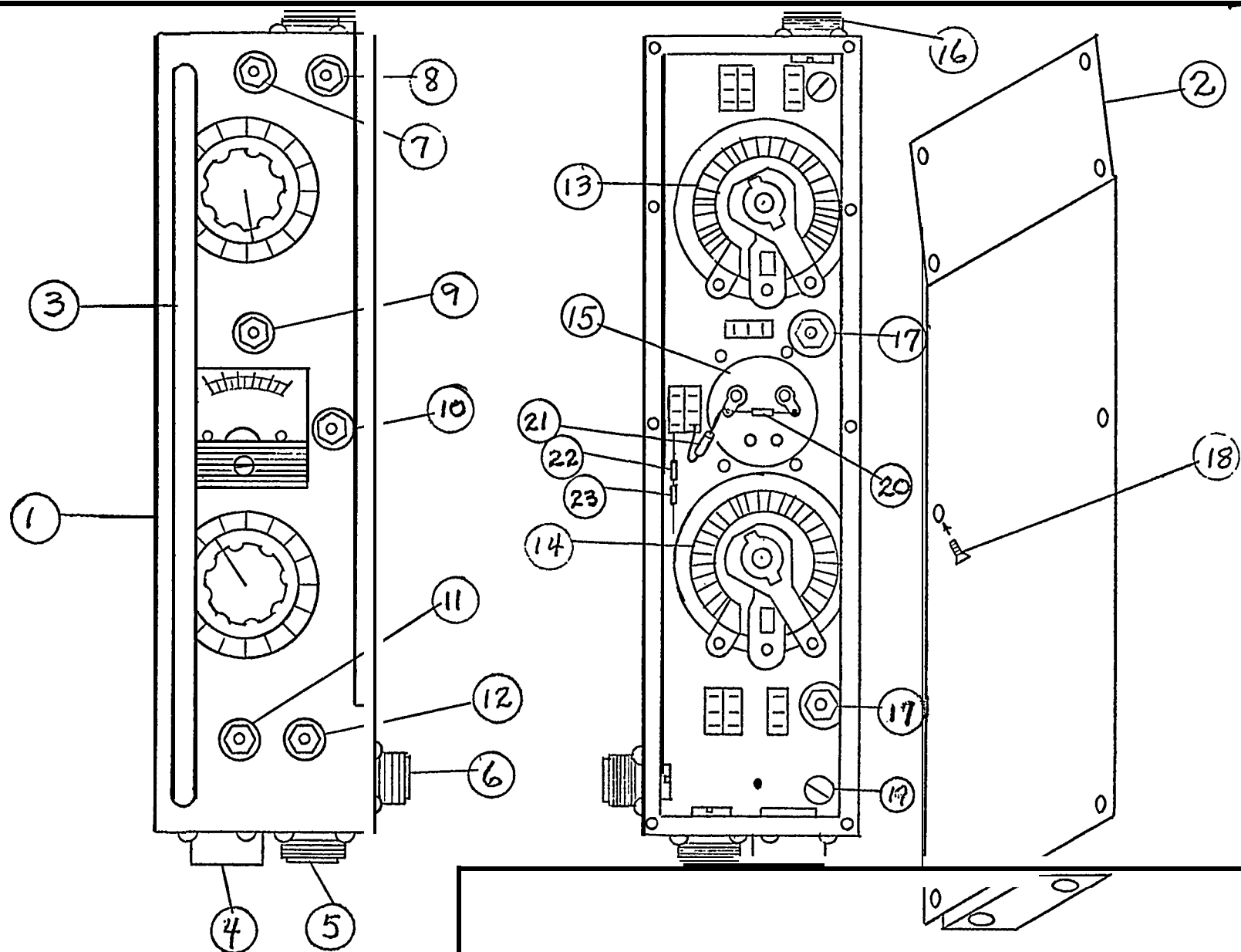
DRAWING NUMBER
9000-0009

MTG-9000-0009 WIRE REEL MOUNTING UNIT PARTS LIST

SEE DRAWING NO. 9000-0009

All Information Above This Line Must Accompany Parts Orders

Part No.	Description	Qty. Reqd.
9000-0009-1	Reel arm	1
9000-0009-2	Coil holder for welding wire	1
9030-0009-3	Reel arm coil holder bracket	1
9000-0009-4	Self locking nut (¼-20)	2
9000-0009-5	Machine screw (¼-20 x 1¼ FH)	2
9000-0009-6	Bracket insulator washer	1
9000-0009-7	Coil holder insulator tube	1
9000-0009-8	Coil holder insulator washer	1
9000-0009-9	Key lock washer	1
9000-0009-10	Coil holder tension spring	1
9000-0009-11	T washer	1
9000-0009-12	Cap screw (3/8-16 x 1¼ Hex)	1
9000-0009-13	Stud lock nut	4
9000-0009-14	1/8 x 1 shaft pin	4
9000-0009-15	Coil holder wire tension stud	4
9000-0009-16	Tension stud pivot arm	4
9000-0009-17	Pivot arm tension spring	4
9000-0009-18	3/8" flat washer	4
9000-0009-19	Tension wing nut	4



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DATE: 3-16-76

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MTG-9000 AUTOMATIC VERTICAL WELDER

REMOTE VOLTAGE, CURRENT, AND
THERMAL CURRENT LIMIT

DRAWING NUMBER..

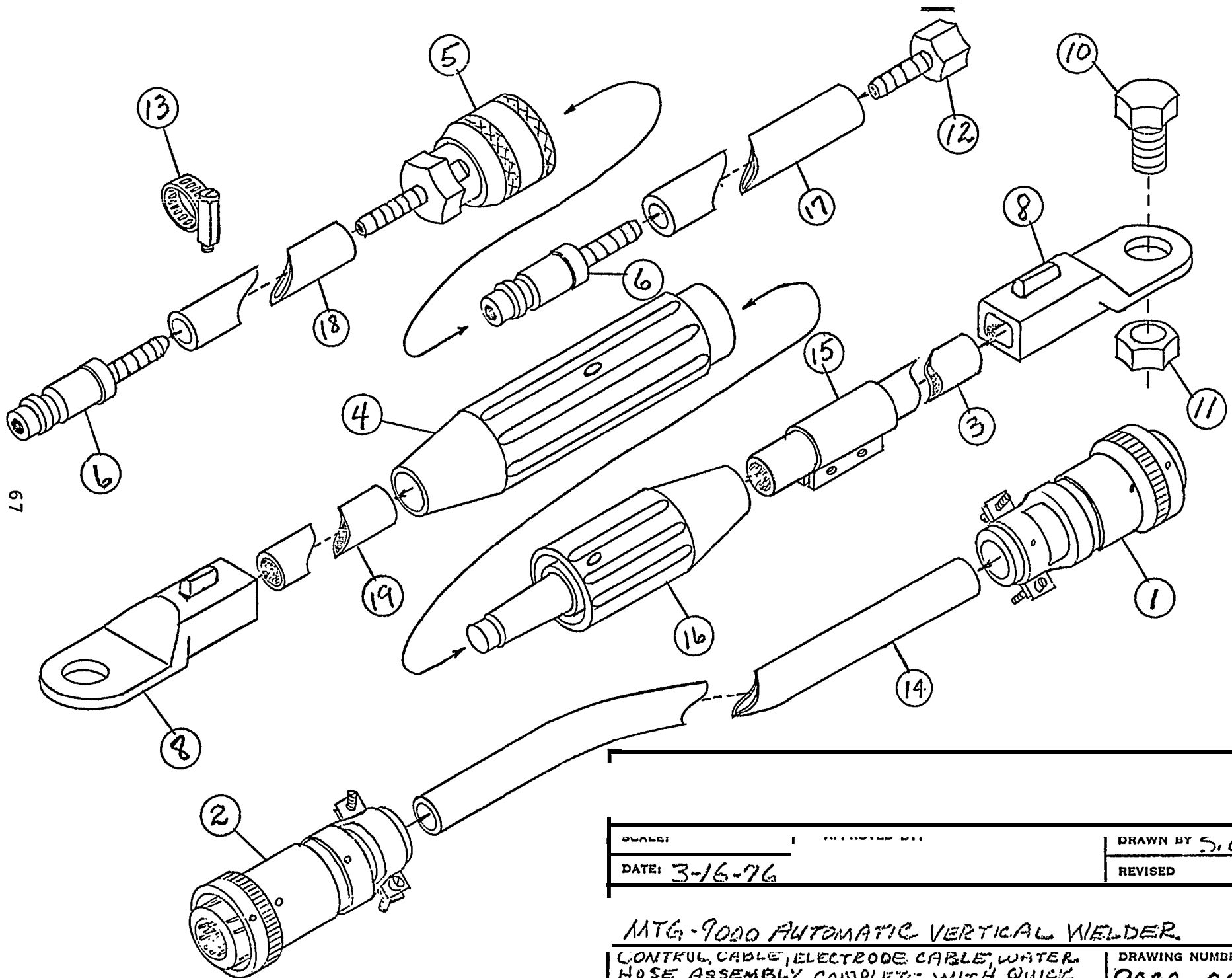
9000-0010

MTG-9000-0010 REMOTE VOLTAGE CURRENT
AND TRAVEL CONTROL UNIT PARTS LIST

DRAWING NO. 9000-0010

All Information Above This Line Must Accompany Parts Orders

Part No.	Description	Qty . Reqd.
9000-0010-1	Case	1
9000-0010-2	Case cover	1
9000-0010-3	Instrument protection arm	1
9000-0010-4	55 pin male socket	1
9000-0010-5	6 pin female socket (small)	1
9000-0010-6	4 pin female socket	1
9000-0010-7	Weld-inch switch	1
9000-0010-8	Forward-off-reverse switch	1
9000-0010-9	Increase-decrease voltage switch	1
9000-0010-10	Volt-amp switch for meter	1
9000-0010-11	Manual-automatic travel switch	1
9000-0010-12	Forward-off-reverse travel switch	1
9000-0010-13	Wire speed rheostat	1
9000-0010-14	Travel speed rheostat	1
9000-0010-15	Volt-ammeter	1
9000-0010-16	4 pin female socket	1
9000-0010-17	Resistor 8W 100 ohm	2
9000-0010-18	Screw (4-40 x ¼ FCSK)	8
9000-0010-19	Screw (8-32 x ½ Truss head)	2
9000-0010-20	500 ohm ½ watt resistor	1
9000-0010-21	330 ohm ½ watt resistor	1
9000-0010-22	270,000 ohm ½ watt resistor	1
9000-0010-23	15,000 ohm ½ watt resistor	1



67

SCALE:	1	DATE:	3-16-76	DRAWN BY:	S. C.
				REVISED:	

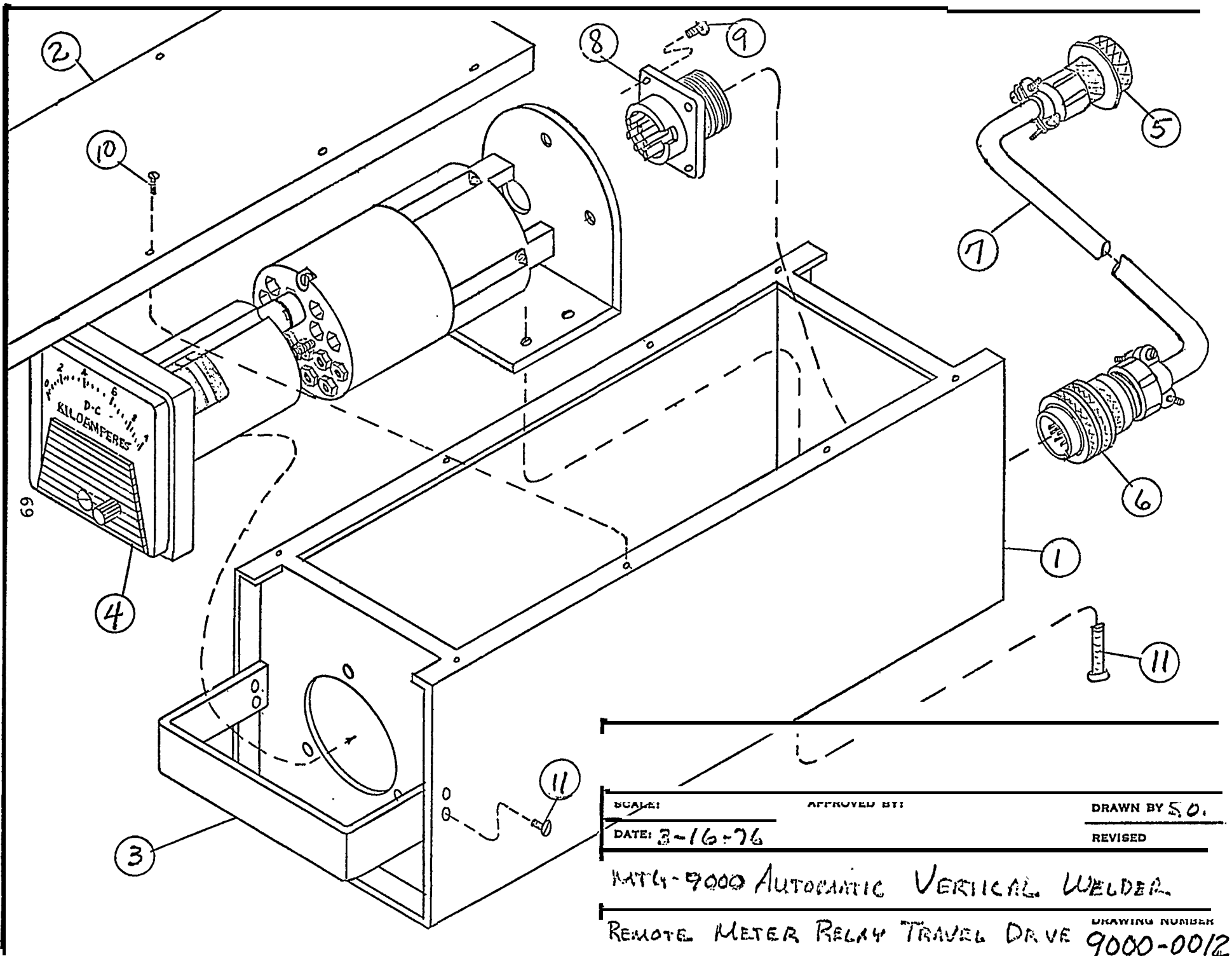
MTG-9000 AUTOMATIC VERTICAL WELDER
 CONTROL CABLE, ELECTRODE CABLE, WATER
 HOSE ASSEMBLY COMPLETE WITH QUICK
 65
 DRAWING NUMBER
 9000-001/

MTG-9000-0011 CONTROL CABLE, ELECTRODE CABLE , AND
WATER HOSE ASSEMBLY COMPLETE WITH QUICK DISCONNECT
FITTINGS PARTS LIST

SEE DRAWING NO. 9000-0011

All Information Above This Line Must Accompany Parts Orders

Part No.	Description	Qty. Reqd.
9000-0011-1	55 pin female plug--tractor end	1
9000-0011-2	55 pin male plug--power source end	1
9000-0011-3	Electrode cable--tractor mounted 36" (Specify 2/0 or 4/0)	1
9000-0011-4	Female quick disconnect--electrode	1
9000-0011-5	Female quick disconnect--water	2
9000-0011-6	Male quick disconnect--water	4
9000-0011-8	Lug for electrode cable	2
9000-0011-10	Cap screw (1/2-13 x 1 Hex)	1
9000-0011-11	Hex nut 1/2-13	1
9000-0011-12	3/8 nut and nipple	1
9000-0011-13	Hose clamp	8
9000-0011-14	Multi-conductor control cable (specify length)	1
9000-0011-15	Electrode cable mounting clamp	1
9000-0011-16	Male quick disconnect--electrode	1
9000-0011-17	3/8 water hose-tractor mounted 241"	2
9000-0011-18	3/8 water hose (Specify length)	2
9000-0011-19	Electrode cable (Specify length and specify 2/0 or 4/0)	1



SCALE:

APPROVED BY:

DRAWN BY S.O.

DATE: 3-16-76

REVISED

KATH-9000 AUTOCENTRIC VERTICAL WELDER.

REMOTE METER RELAY TRAVEL DRIVE

DRAWING NUMBER

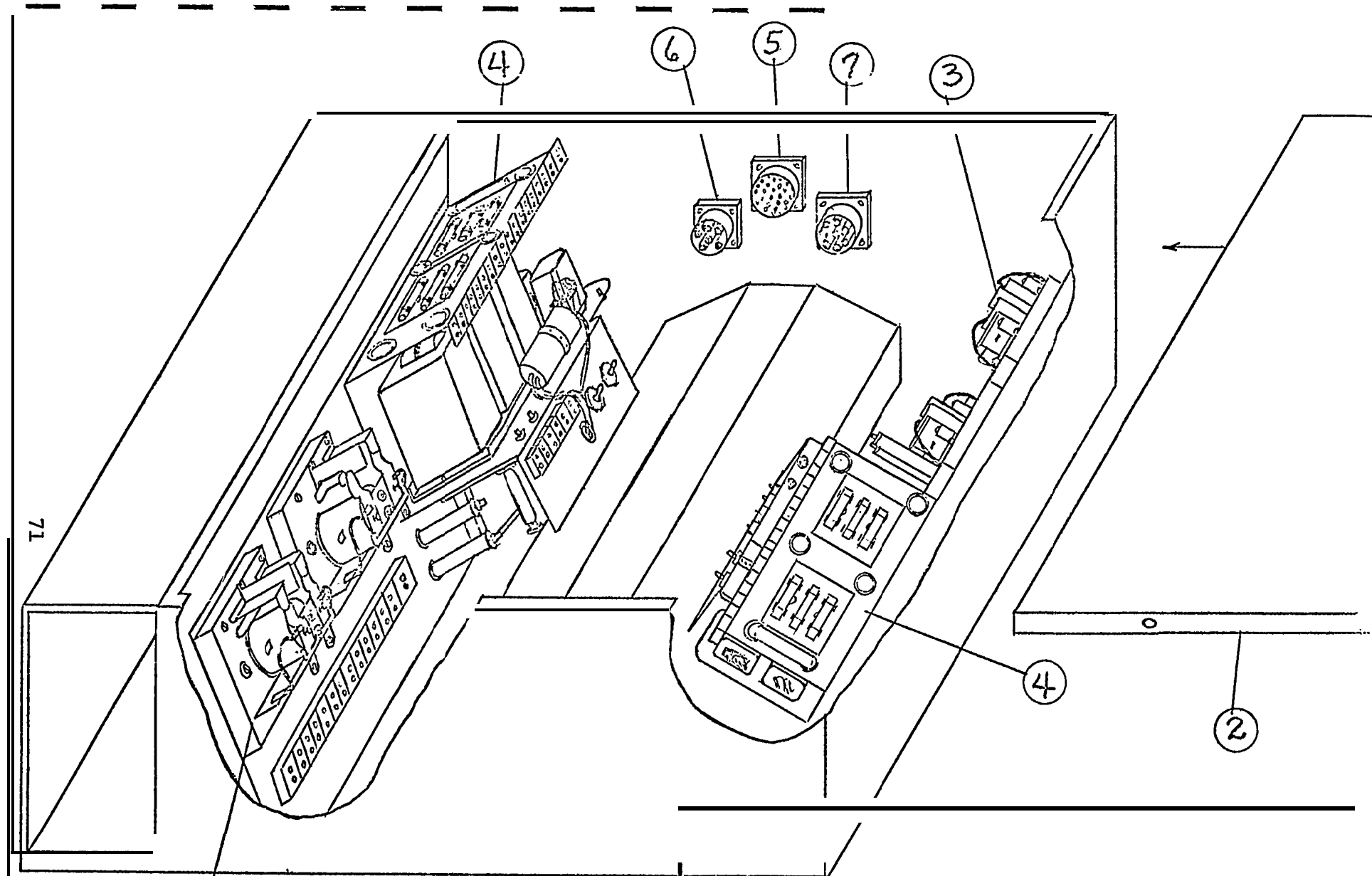
9000-0012

MTG -9000-0012 REMOTE METER RELAY TRAWEL DRIVE PARTS LIST

SEE DRAWING NO. 9000-0012

All Information Above This Line Must Accompany Parts Orders

Part No.	Description	Qty. Reqd .
9000-0012-1	Case	1
9000-0012-2	Case cover	1
9000-0012-3	Case handle	1
9000-0012-4	Meter relay	1
9000-0012-5	6 pin male plug (small)	1
9000-0012-6	6 pin male plug (large)	1
9000-0012-7	Multi-conductor cable 10'	1
9000-0012-8	6 pin female socket (large)	1
9000-0012-9	Screw (6-32 x ¼ STPH)	4
9000-0012-10	Screw (4-40 x ¼ PH)	8
9000-0012-11	Screw (10-32 x ¼" PH)	8



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DATE: *3-16-76*

REVISED

MTG-9000 AUTOMATIC VERTICAL VIEWER PAGE 1

DRAWING NUMBER

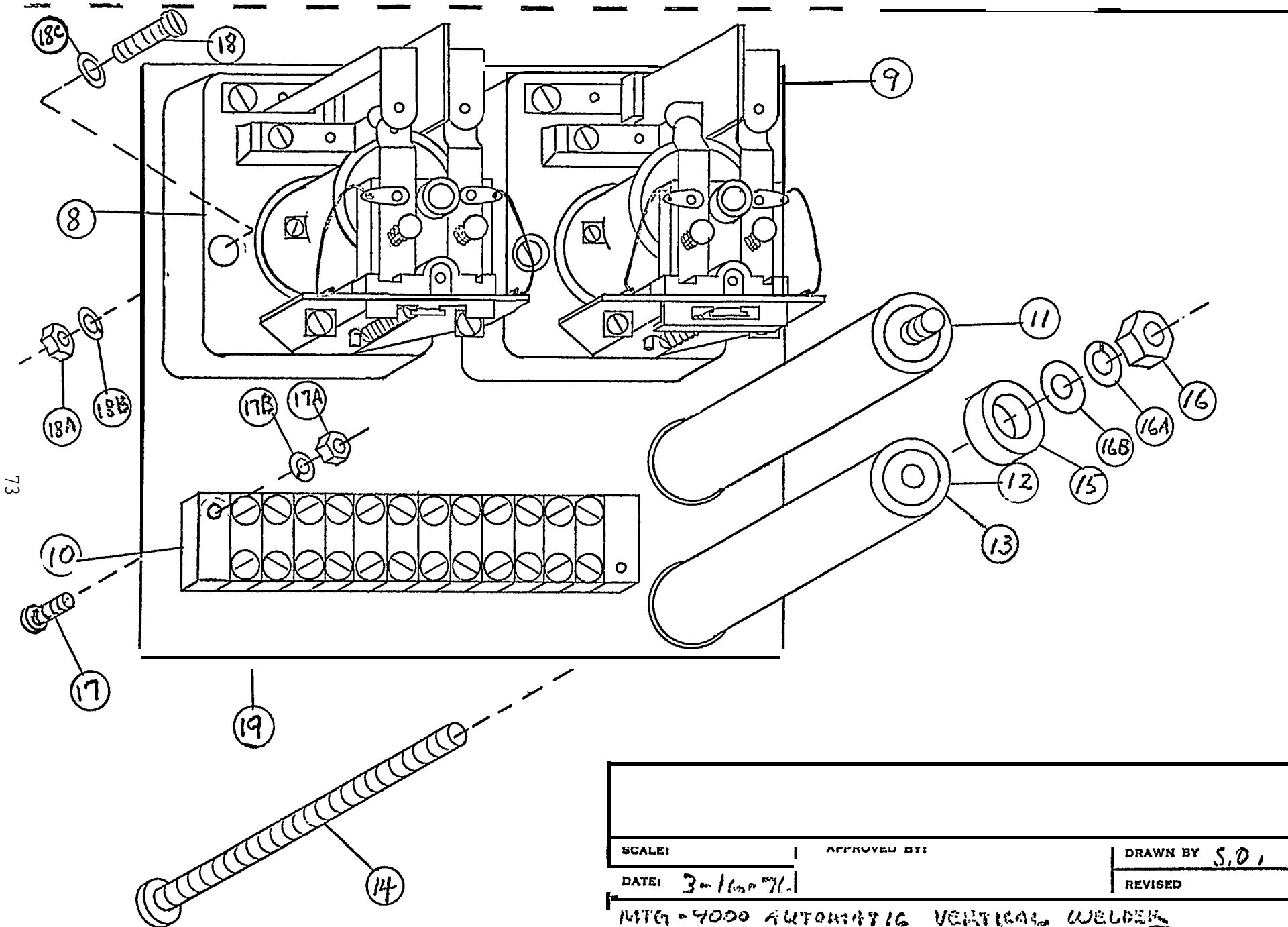
9000-0013

MTG-9000-0013 MAIN CONTROL BOX PARTS LIST

SEE DRAWING NO. 9000-0013
Page 1

All Information Above This Line Must Accompany Parts Orders

Part No.	Description	Qty . Reqd.
9000-0013-1	Case	1
9000-0013-2	Case cover	1
9000-0013-3	Travel and wire feed relay panel assembly	2
9000-0013-4	Travel and wire feed magnetic amplifier panel assembly	2
9000-0013-5	55 pin female socket	1
9000-0013-6	5 pin female socket	1
9000-0013-7	8 pin female socket	1



SCALE:	APPROVED BY:	DRAWN BY S.D.
DATE: 3-16-71		REVISED

MTG-9000 AUTOMATIC VERTICAL WELDER

TRAVEL AND WIRE FEED RELAY PANEL

PAGE 2.

DRAWING NUMBER: 0000-0013

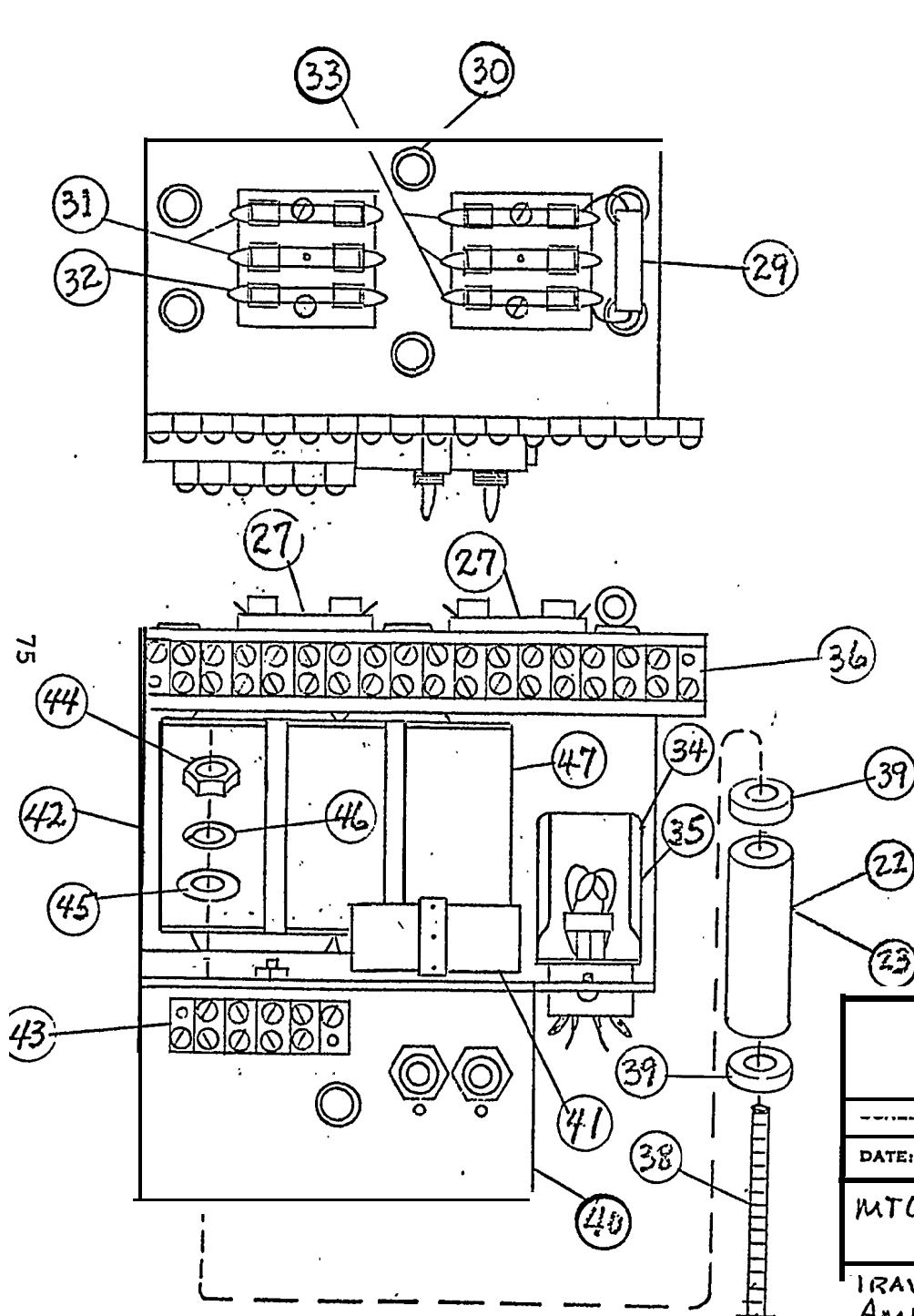
73

MTG-9000-0013 TRAVEL AND WIRE FEED RELAY PANEL
PARTS LIST

SEE DRAWING NO. 9000-0013
Page 2

All Information Above This Line Must Accompany Parts Orders

Part No.	Description	Qty. Reqd.
9000-0013-8	Relay-RR-120VAC.	1
9000-0013-9	Relay-MR-100VAC.	1
9000-0013-10	12 pt. terminal block	1
9000-0013-11	10 ohm 25w resistor	1
9000-0013-12	500 ohm 25W resistor for travel relay panel	1
9000-0013-13	200 ohm 25W resistor for wire feed relay panel	1
9000-0013-14	Screw (10-32 x 2-3/4 RH)	2
9000-0013-15	Insulating washer	4
9000-0013-16	Hex nut 10-32	2
9000-0013-16A	#10 lock washer	2
9000-0013-16B	#10 flat washer	2
9000-0013-17	Screw (6-32 x 1/2 PH)	2
9000-0013-17A	Hex nut 6-32	2
9000-0013-17B	#6 lock washer	2
9000-0013-18	Screw (8-32 x 5/8 PH)	4
9000-0013-18A	Hex nut 8-32	4
9000-0013-18B	#8 lock washer	4
9000-0013-18C	#8 flat washer	4
9000-0013-19	Panel only	1



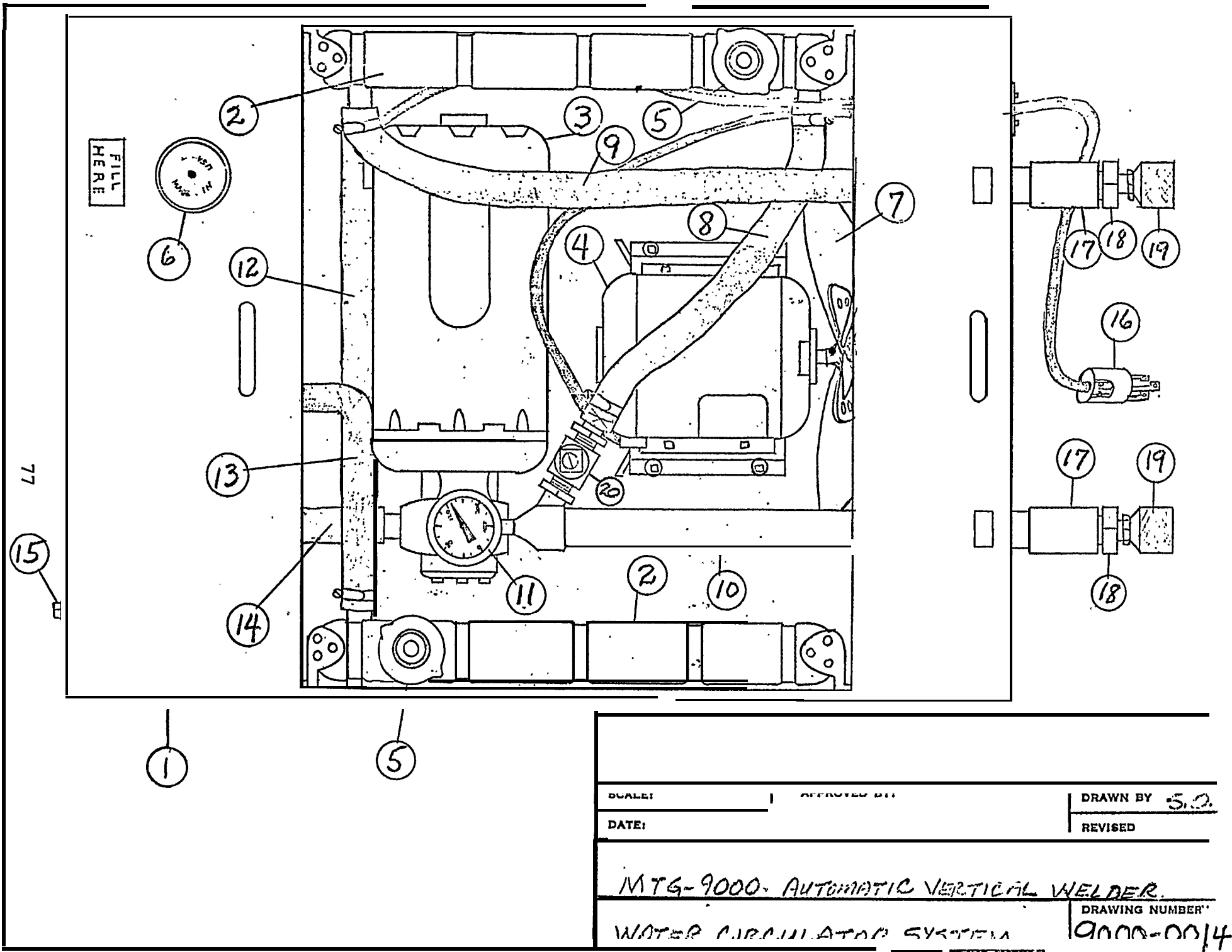
DATE: 3-16-76		DRAWN BY J.D.
MTG-9000 AUTOMATIC VERTICAL WELDER		REVISED
TRAVEL AND WIRE FEED MAGNETIC		PAGE 2
AMPLIFIER DRIVE Assembly		DRAWING NUMBER
		9000-0013

MTG-9000-0013 TRAVEL AND WIRE FEED MAGNETIC
AMPLIFIER PANEL ASSEMBLY PARTS LIST

SEE DRAWING NO. 9000-0013
Page 3

All Information Above This Line Must Accompany Parts Orders

Part No.	Description	Qty. Reqd.
9000-0013-20	Small transformer	1
9000-0013-21	Large transformer	1
9000-0013-22	400 ohm 25W resistor	1
9000-0013-23	1000ohm 25W resistor	1
9000-0013-24	Feedback switch	1
9000-0013-25	8 pin octal socket	2
9000-0013-26	Arc-input switch	2
9000-0013-27	3 fuse mount	2
9000-0013-29	30MFD 150WV capacitor	1
9000-0013-30	Rubber grommet	5
9000-0013-31	1½ amp AGC fuse	2
9000-0013-32	4 amp MDL fuse	1
9000-0013-33	¼ amp AGC fuse	3
9000-0013-34	Standard #58 diode bridge	1
9000-0013-35	Double diode bridge	1
9000-0013-36	16 pt. terminal block	1
9000-0013-38	Screw (10-32 x 2-3/4" RH)	2
9000-0013-39	Insulator washer	4
9000-0013-40	Switch panel only	1
9000-0013-41	50-50 MFD 150WV capacitor	1
9000-0013-42	Magnetic amplifier panel only	1
9000-0013-43	4 pt. terminal block	1
9000-0013-44	Hex nut 10-32	2
9000-0013-45	#10 flat washer	2
9000-0013-46	#10 lock washer	2
9000-0013-47	Magnetic amplifier coil assembly	1

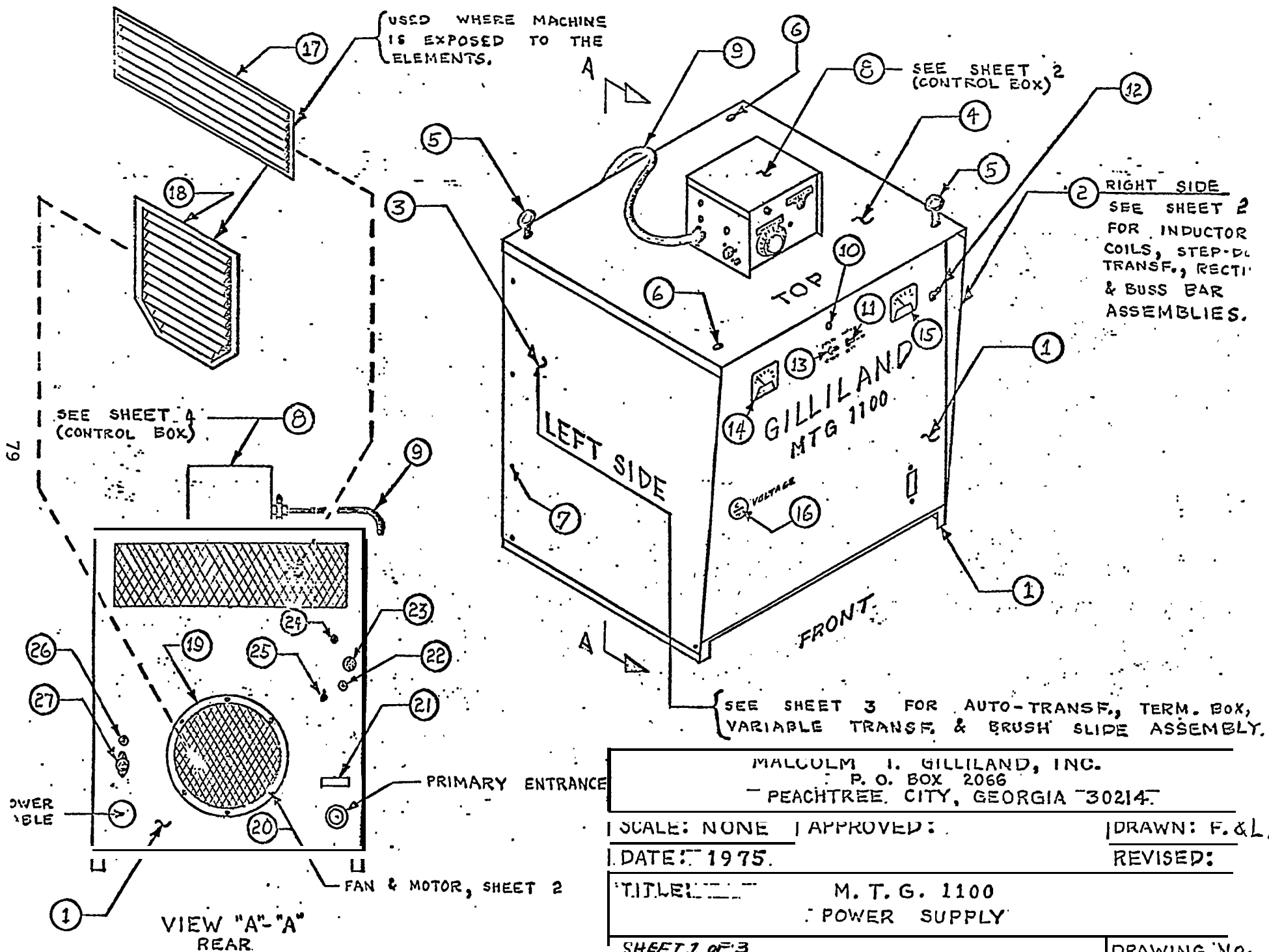


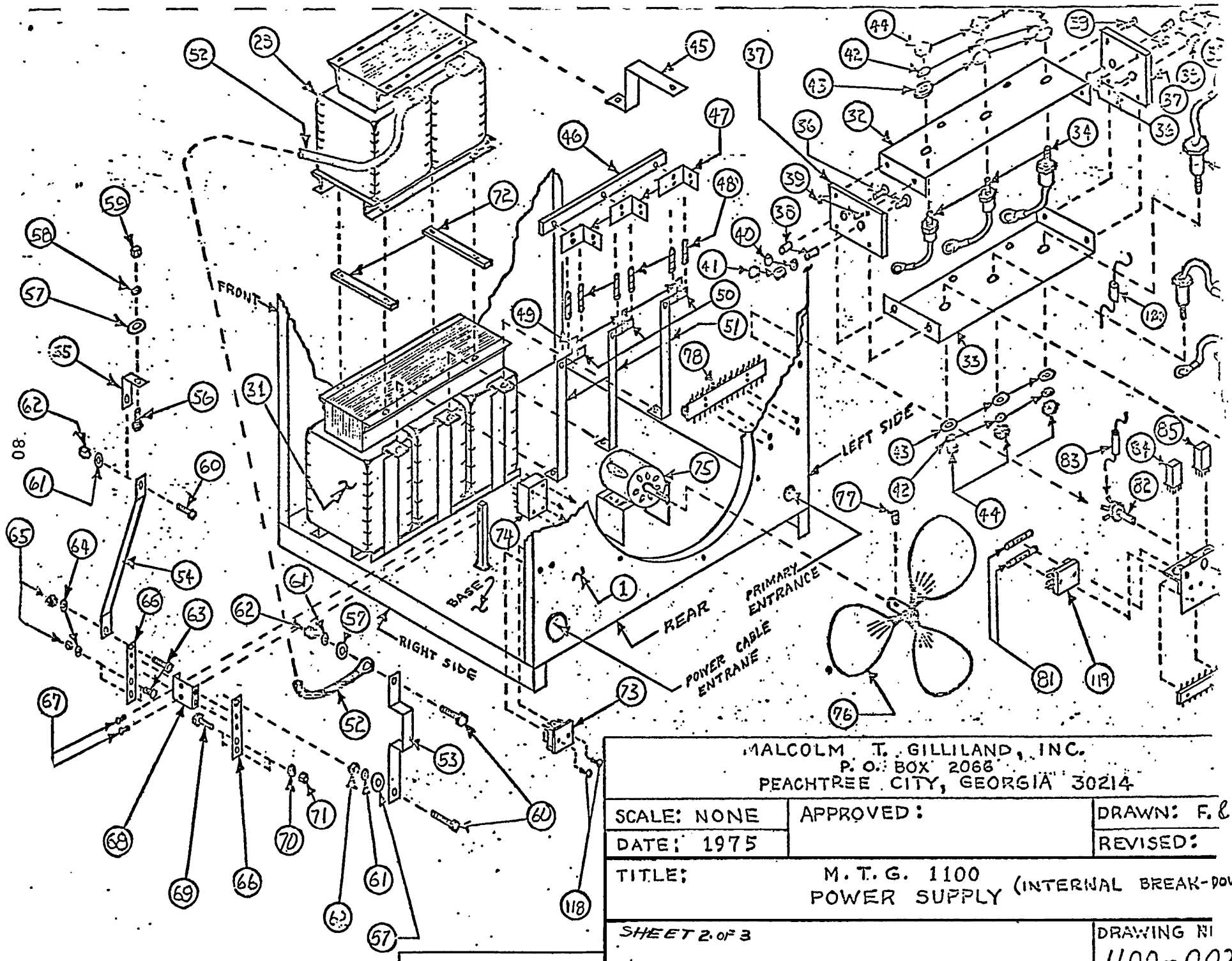
MTG-9000-0014 WATER CIRCULATOR SYSTEM PARTS LIST

SEE DRAWING NO. 9000-0014

All Information Above This Line Must Accompany Parts Orders

Part No.	Description	Qty. Reqd.
9000-0014-1	Case	1
9000-0014-2	Radiator	2
9000-0014-3	Pump	1
9000-0014-4	Fan motor	1
9000-0014-5	Radiator cap	2
9000-0014-6	Reservoir cap	1
9000-0014-7	Fan blade	1
9000-0014-8	1¼ hose--12" long	1
9000-0014-9	1¼ hose--22" long	1
9000-0014-10	1" pipe--17" long	1
9000-0014-11	Pressure gauge	1
9000-0014-12	1¼ hose--19" long	1
9000-0014-13	1¼ hose--14" long	1
9000-0014-14	1¼ hose--6" <i>long</i>	1
9000-0014-15	Drain plug	1
9000-0014-16	3 pin male twist lock plug	1
9000-0014-17	1" pipe coupling	2
9000-0014-18	1" to ½" pipe bushing	2
9000-0014-19	½" pipe thread female quick disconnect fitting	2
9000-0014-20	Pressure regulator	1





MALCOLM T. GILLILAND, INC.
P. O. BOX 2066
PEACHTREE CITY, GEORGIA 30214

SCALE: NONE

APPROVED:

DRAWN: F. &

DATE: 1975

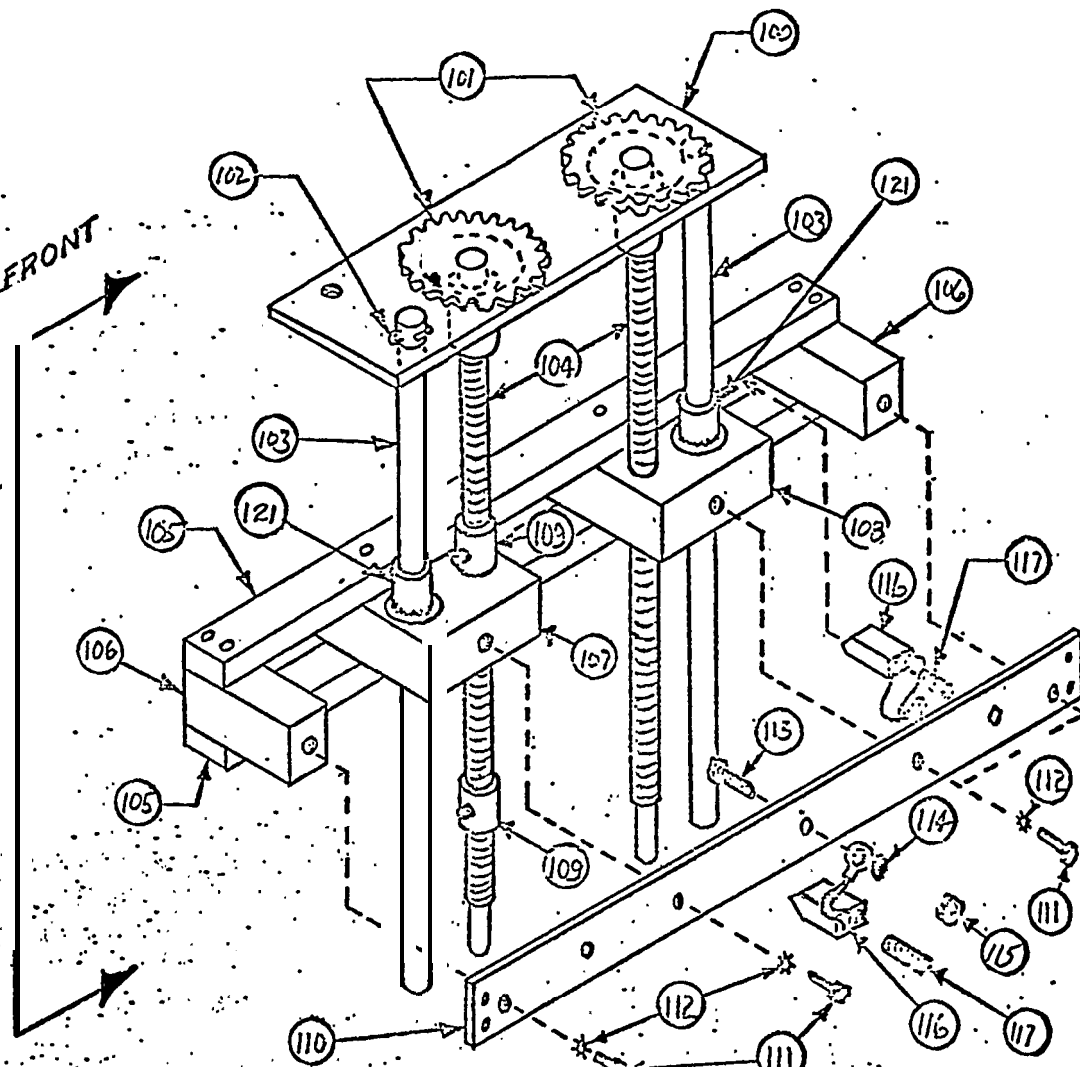
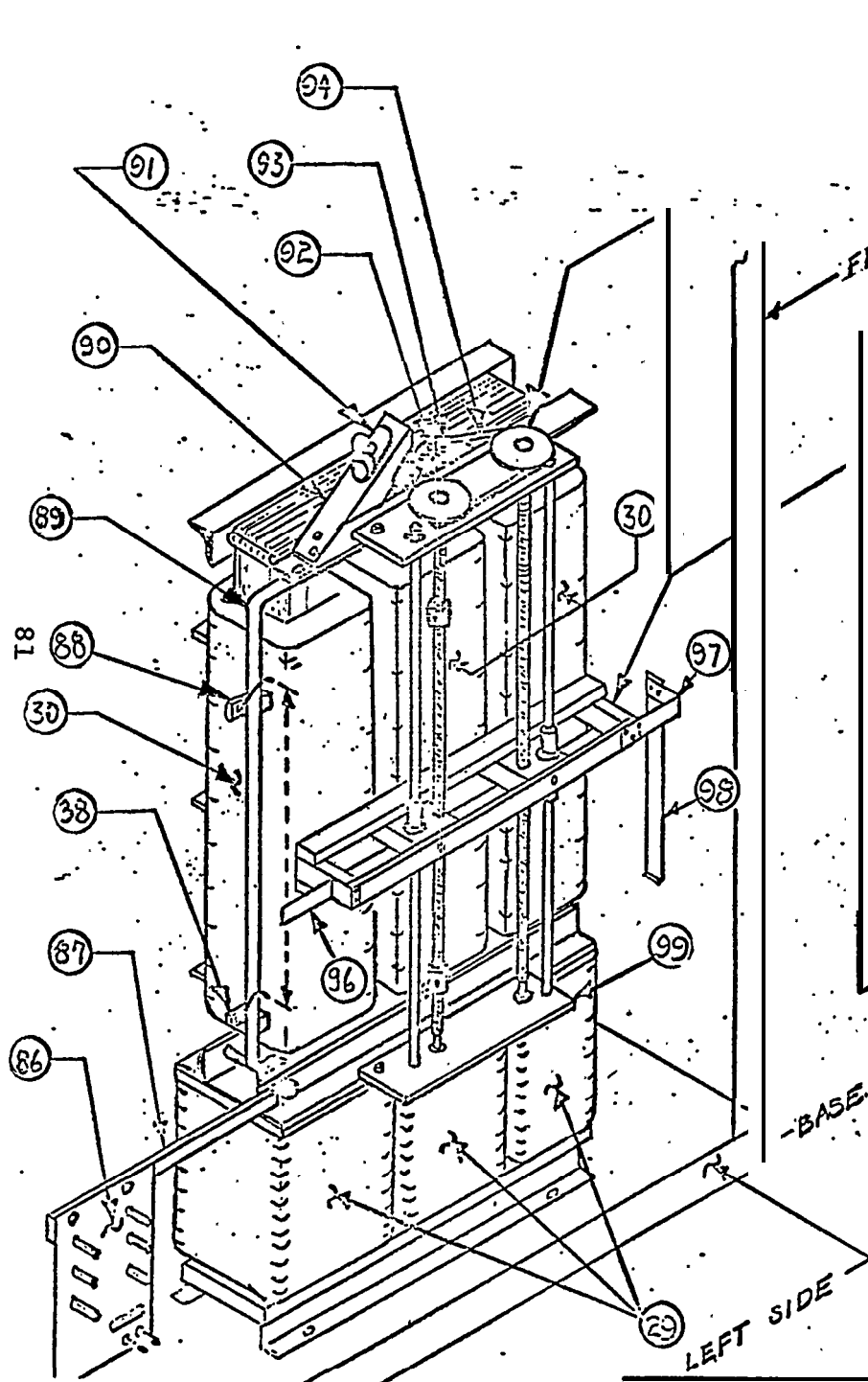
REVISED:

TITLE:

M. T. G. 1100
POWER SUPPLY (INTERNAL BREAK-DOWN)

SHEET 2 OF 3

DRAWING NO
1100-0.02



MALCOLM T. GILLILAND, INC.
P.O. BOX 2066
PEACHTREE CITY, GEORGIA 30214

SCALE: NONE

APPROVED:

DRAWN: F. & L.

DATE: 1975

REVISED:

TITLE:

M. T. G. 1100
POWER SUPPLY (INTERNAL BREAK-DOWN)

SHEET 3 OF 3

DRAWING NUMBER

1100-003

MTG-1100 POWER SOURCE

Item No.	Part No.	Description
1	MTG-S1100-11001	Power Source Main Case
2	MTG-S1100-11002	Cover for Right Side-Power Source
3	MTG-S1100-11003	Cover for Left Side-Power Source
4	MTG-S1100-11004	Top Cover for Power Source
5	MTG-S1100-11005	Lifting eye-Power Supply (2 required)
6	MTG-S1100-11006	Top Cover Mounting Bolt(2 required)
7	MTG-S1100-11007	Side Cover Mounting Bolt (20 Required)
8	MTG-S1100-11008	(MIG-60 Control Box, Complete)
9	MTG-S1100-11009	(MTG-60-69 Multi Conductor Control Lead)
10	MTG-S1100-11010	Pilot Light
11	MTG-S1100-11011	Manual-Automatic Water Control Switch
12	MTG-S1100-11012	On-off Main Power Switch
13	MTG-S1100-11013	Raise-Lower Automatic Voltage Adjustment Switch
14	MTG-S1100-11014	Voltmeter 0-50 V. DC
15	MTG-S1100-11015	0-1500 Amp Ammeter DC
16	MTG-S1100-11016	Clear Plastic Voltage Vernier Cover
17	MTG-S1100-11017	Top Diode Stack Louver
18	MTG-S1100-11018	Fan Shroud Louver
19	MTG-S1100-11019	Fan Shroud
20	MTG-S1100-11020	Mounting Bolts for Fan Shroud (2 Required)
21	MTG-S1100-11021	Nameplate
22	IWG-S1100-11022	5 Pin Socket
23	MTG-S1100-11023	8 Pin Socket
24	MTG-S1100-11024	Burnback Adjustment Control
25	MTG-S1100-11025	Sub Arc/Auto Vertical Conversion Switch
26	MTG-s1100-11026	15 Amp Fuse Holder
27	MTG-S1100-11027	Water Control Recepticle
28	MTG-S1100-11322	Inductor
29	MTG-S1100-11348	Auto Transformer
30	MTG-S1100-11869	Variable Transformer
31	MTG-S1100-11346	Stepdown Transformer
32	MTG-S1100-11032	Top Plate for Diode Stack
33	MTG-S1100-11033	Bottom Plate for Diode Stack
34	MTG-S1100-11034	Diode (3 Required)
35	MIG-S1100-11035	Diode (3 Required)
36	MTG-s1100-11036	Diode Stack Mounting Bolts
37	MTG-S1100-11037	Diode Stack Mounting Insulator Plate (2 Required)
38	NTG-S1100-11038	Spacers (4 Required)
39	MTG-S1100-11039	Insulator Mounting Bolts, Nuts and Washers (8 required)
40	MTG-S1100-11040	Mounting Washers (8 required)
41	MTG-S1100-11041	Nuts (4 Required)
42	MTG-S1100-11042	Diode Mounting Washer (6 Required)

MTG-1100 Power Source

Item No.	Part No.	Description
43	MTG-S1100-11043	Diode Mounting Lock Washer (6 Required)
44	MTG-S1100-11044	Diode Mounting Nut (6 Required)
45	MTG-S1100-11045	Bracket-Inductor to Diode Stack
46	MTG-S1100-11046	Insulator
47	MTG-S110-11047	Diode Lead Mounting Bracket (3 Required)
48	MTG-S1100-11048	Fuse (6 Required)
49	MrG-S1100-11049	Insulator Supports (3 Required)
50	MTG-S1100-11050	Fuse Mounting Bracket (3 Required)
51	MTG-S1100-11051	Transformer Shunt Bar (3 Required)
52	MTG-S1100-11052	Cable-Inductor to Positive Output Shunt
53	MTG-S1100-11053	Positive Shunt Bar
54	MTG-S1100-11054	Negative Shunt Bar
55	MIG-S1100-11055	Negative Shunt Bar Mounting Bracket
56	MIG-S1100-11056	Bolt, Shunt Bar Mounting
57	MTG-S1100-11057	Flat Washer- $\frac{1}{4}$ inch thick (8 Required)
58	MIG-S1100-11058	Flat Washer, Shunt Bar Mounting
59	MTG-S1100-11059	Nut, Shunt Bar Mounting
60	MTG-S1100-11060	Bolt, Positive shunt Bar Mounting (3 Required)
61	MTG-s1100-11061	Flat Washer, Positive Shunt Bar Mounting
62	MTG-S1100-11062	Nut, Positive Shunt Bar Mounting
63	MTG-S1100-11063	Bolt, Output Shunt Bar
64	MTG-S1100-11064	Washer, Output Shunt Bar
65	MTG-S1100-11065	Nut, Output Shunt Bar
66	MTG-S1100-11066	Output Shunt Bar (2 Required)
67	MIG-s1100-11067	Bolt, Flat Washer, Lock Washer (2 Required)
68	MIG-S1100-11068	Output Insulator Mounting Bracket
69	MTG-S1100-11069	Bolt, Cable to Output Shunt Bar (4 Required)
70	MTG-S1100-110700	Washer (4 Required)
71	MTG-S1100-11071	Nut (4 Required)
72	MTG-s1100-11072	Insulator (2 Required)
73	MIG-S1100-11073	Relay
74	MTG-S1100-11074	Receptacle
75	MTG-S1100-11075	Fan Motor

MT G-1100 POWER SOURCE

Item No.	Part No.	Description
76	MTG-S1100-11076	Fan Blade
77	MTG-S1100-11077	Fan Blade Set Screw
78	MTG-S1100-11078	Terminal Strip
79	MTG-S1100-11079	Burnback Panel
80	MTG-S1100-11080	Terminal Strip
81	MTG-S1100-11081	1½ Amp Fuse
82	MTG-S1100-11082	Burnback Potentiometer
83	MIG-S1100-11083	Pesistor
84	MIG-S1100-11084	Diode Bridge
85	MTG-S1100-11085	Relay
86	MIG-S1100-11086	Input Voltage Panel
87	MTG-S1100-11087	Bracket
88	MTG S1100-11088	Limit Switch (2 Required)
89	MTG-S1100-11089	Mounting Bracket for Limit Switch
90	MTG-S1100-11090	Voltage Adjustment Motor Mounting Bracket
91	MTG-S1100-11091	Capacitor
92	MTG-S1100-11092	Voltage Adjustment Motor
93	MTG-S1100-11093	Sprocket
94	MTG-S1100-11094	Chain
95	MTG-S1100-11095	Brush Holder Assembly
96	MTG-S1100-11096	Limit Switch Stop Bracket
97	MTG-S1100-11097	Mounting Bracket for Voltage Vernier
98	MTG-S1100-11098	Voltage Vernier
99	MTG-S1100-11099	Botton Brush Holder Mounting Plate
100	MTG-S1100-11100	Top Brush Holder Mounting Plate
101	MTG-S1100-11101	Sprocket (2 Required)
102	MTG-S1100-11102	Cotter Pin
103	MTG-S1100-11103	Support Guide Rods (2 Required)
104	MTG-S1100-11104	Threaded Guide Rod (2 Required)
105	MTG-S1100-11105	Brush Guide Insulator Strip (2 Required)
106	MTG-S1100-11106	Brush Holder Insulator End Bracket (2 Required)
107	MIG-S1100-11107	Brush Holder Insulator Guide Bracket-Left Side
108	MTG-S1100-11108	Brush Holder Insulator Guide Bracket-Right Side
109	MTG-S1100-11109	Brush Holder Threaded Guide Stop (2 Required)

MTG-1100 POWER SOURCE

Item No.	Part No.	Description
110	MTG-S1100-11110	Brush Holder Front Insulator Strip
111	MTG-S1100-11111	Mounting Bolt (3 Required)
112	MTG-S1100-11112	Washer (3 Required)
113	MTG-S1100-11113	Brush Pigtail Mounting Bolt (3 Required)
114	MTG-S1100-11114	Washer (3 Required)
115	MTG-S1100-11115	Nut (3 Required)
116	MTG-S1100-11116	Brush (12 Required)
117	MTG-S1100-11117	Spring (12 Required)
118	MTG-S1100-11118	Mounting screw (2 Required)
119	MTG-S1100-11119	Fuse Block
120	MTG-S1100-11120	Capacitor
121	MTG-S1100-11121	Support Guide Insulator (2 Required)